# autogluon_each_location

October 7, 2023

[96]:
```
import pandas as pd
import numpy as np



import warnings
warnings.filterwarnings("ignore")

def fix_datetime(X, name):
    # Convert 'date_forecast' to datetime format and replace original column␣
 ↪with 'ds'
    X['ds'] = pd.to_datetime(X['date_forecast'])
    X.drop(columns=['date_forecast'], inplace=True, errors='ignore')
    X.sort_values(by='ds', inplace=True)
    X.set_index('ds', inplace=True)

    # Drop rows where the minute part of the time is not 0
    X = X[X.index.minute == 0]
    return X



def convert_to_datetime(X_train_observed, X_train_estimated, X_test, y_train):
    X_train_observed = fix_datetime(X_train_observed, "X_train_observed")
    X_train_estimated = fix_datetime(X_train_estimated, "X_train_estimated")
    X_test = fix_datetime(X_test, "X_test")

    # add sample weights, which are 1 for observed and 3 for estimated
    X_train_observed["sample_weight"] = 1
    X_train_estimated["sample_weight"] = 3
    X_test["sample_weight"] = 3

    X_train_observed["estimated_diff_hours"] = 0
    X_train_estimated["estimated_diff_hours"] = (X_train_estimated.index - pd.
 ↪to_datetime(X_train_estimated["date_calc"])).dt.total_seconds() / 3600
    X_test["estimated_diff_hours"] = (X_test.index - pd.
 ↪to_datetime(X_test["date_calc"])).dt.total_seconds() / 3600
```

```
    X_train_estimated["estimated_diff_hours"] =␣
 ↪X_train_estimated["estimated_diff_hours"].astype('int64')
    # the filled once will get dropped later anyways, when we drop y nans
    X_test["estimated_diff_hours"] = X_test["estimated_diff_hours"].fillna(-50).
 ↪astype('int64')


    X_train_estimated.drop(columns=['date_calc'], inplace=True)
    X_test.drop(columns=['date_calc'], inplace=True)

    y_train['ds'] = pd.to_datetime(y_train['time'])
    y_train.drop(columns=['time'], inplace=True)
    y_train.sort_values(by='ds', inplace=True)
    y_train.set_index('ds', inplace=True)

    return X_train_observed, X_train_estimated, X_test, y_train




def preprocess_data(X_train_observed, X_train_estimated, X_test, y_train,␣
 ↪location):
    # convert to datetime
    X_train_observed, X_train_estimated, X_test, y_train =␣
 ↪convert_to_datetime(X_train_observed, X_train_estimated, X_test, y_train)

    y_train["y"] = y_train["pv_measurement"].astype('float64')
    y_train.drop(columns=['pv_measurement'], inplace=True)
    X_train = pd.concat([X_train_observed, X_train_estimated])

    # fill missng sample_weight with 3
    #X_train["sample_weight"] = X_train["sample_weight"].fillna(0)


    # clip all y values to 0 if negative
    y_train["y"] = y_train["y"].clip(lower=0)

    X_train = pd.merge(X_train, y_train, how="inner", left_index=True,␣
 ↪right_index=True)

    # print number of nans in sample_weight
    print(f"Number of nans in sample_weight: {X_train['sample_weight'].isna().
 ↪sum()}")
    # print number of nans in y
    print(f"Number of nans in y: {X_train['y'].isna().sum()}")
```

```
    X_train["location"] = location
    X_test["location"] = location

    return X_train, X_test
# Define locations
locations = ['A', 'B', 'C']

X_trains = []
X_tests = []
# Loop through locations
for loc in locations:
    print(f"Processing location {loc}...")
    # Read target training data
    y_train = pd.read_parquet(f'{loc}/train_targets.parquet')

    # Read estimated training data and add location feature
    X_train_estimated = pd.read_parquet(f'{loc}/X_train_estimated.parquet')

    # Read observed training data and add location feature
    X_train_observed= pd.read_parquet(f'{loc}/X_train_observed.parquet')

    # Read estimated test data and add location feature
    X_test_estimated = pd.read_parquet(f'{loc}/X_test_estimated.parquet')

    # Preprocess data
    X_train, X_test = preprocess_data(X_train_observed, X_train_estimated,␣
↪X_test_estimated, y_train, loc)

    X_trains.append(X_train)
    X_tests.append(X_test)

# Concatenate all data and save to csv
X_train = pd.concat(X_trains)
X_test = pd.concat(X_tests)
```

```
Processing location A…
Number of nans in sample_weight: 0
Number of nans in y: 0
Processing location B…
Number of nans in sample_weight: 0
Number of nans in y: 4
Processing location C…
Number of nans in sample_weight: 0
Number of nans in y: 6059
```

# 1 Feature enginering

[97]:
```
# temporary
X_train["hour"] = X_train.index.hour
X_train["weekday"] = X_train.index.weekday
# weekday or is_weekend
X_train["is_weekend"] = X_train["weekday"].apply(lambda x: 1 if x >= 5 else 0)

# drop weekday
#X_train.drop(columns=["weekday"], inplace=True)
X_train["month"] = X_train.index.month
X_train["year"] = X_train.index.year

X_test["hour"] = X_test.index.hour
X_test["weekday"] = X_test.index.weekday

# weekday or is_weekend
X_test["is_weekend"] = X_test["weekday"].apply(lambda x: 1 if x >= 5 else 0)

# drop weekday
#X_test.drop(columns=["weekday"], inplace=True)
X_test["month"] = X_test.index.month
X_test["year"] = X_test.index.year



to_drop = ["snow_drift:idx", "snow_density:kgm3"]

X_train.drop(columns=to_drop, inplace=True)
X_test.drop(columns=to_drop, inplace=True)

X_train.dropna(subset=['y'], inplace=True)
X_train.to_csv('X_train_raw.csv', index=True)
X_test.to_csv('X_test_raw.csv', index=True)
```

[98]:
```
import autogluon.eda.auto as auto
auto.dataset_overview(train_data=X_train, test_data=X_test, label="y",␣
↪sample=None)
```

**train_data dataset summary**

```
                           count  unique top   freq          mean  \
absolute_humidity_2m:gm3   92951     165                 6.017608
air_density_2m:kgm3        92951     293                 1.255435
ceiling_height_agl:m       72276   40993              2802.587891
clear_sky_energy_1h:J      92951   48602             515154.03125
clear_sky_rad:W            92951    7815               143.101395
cloud_base_agl:m           84404   34862              1692.934692
```

| | | | | | |
|---|---|---|---|---|---|
| dew_or_rime:idx | 92951 | 3 | | | 0.007025 |
| dew_point_2m:K | 92951 | 436 | | | 275.237823 |
| diffuse_rad:W | 92951 | 2870 | | | 39.495811 |
| diffuse_rad_1h:J | 92951 | 48553 | | | 142180.03125 |
| direct_rad:W | 92951 | 5296 | | | 50.205017 |
| direct_rad_1h:J | 92951 | 41885 | | | 180740.1875 |
| effective_cloud_cover:p | 92951 | 1001 | | | 67.013527 |
| elevation:m | 92951 | 3 | | | 11.401738 |
| estimated_diff_hours | 92951 | 26 | | | 3.143516 |
| fresh_snow_12h:cm | 92951 | 125 | | | 0.116175 |
| fresh_snow_1h:cm | 92951 | 39 | | | 0.00963 |
| fresh_snow_24h:cm | 92951 | 161 | | | 0.229894 |
| fresh_snow_3h:cm | 92951 | 70 | | | 0.029001 |
| fresh_snow_6h:cm | 92951 | 96 | | | 0.058069 |
| hour | 92951 | 24 | | | 11.501339 |
| is_day:idx | 92951 | 2 | | | 0.483341 |
| is_in_shadow:idx | 92951 | 2 | | | 0.565384 |
| is_weekend | 92951 | 2 | | | 0.286775 |
| location | 92951 | 3 | A | 34061 | |
| month | 92951 | 12 | | | 6.294521 |
| msl_pressure:hPa | 92951 | 874 | | | 1009.502563 |
| precip_5min:mm | 92951 | 64 | | | 0.005674 |
| precip_type_5min:idx | 92951 | 7 | | | 0.083259 |
| pressure_100m:hPa | 92951 | 888 | | | 995.81897 |
| pressure_50m:hPa | 92951 | 897 | | | 1001.949646 |
| prob_rime:p | 92951 | 700 | | | 0.756834 |
| rain_water:kgm2 | 92951 | 11 | | | 0.009677 |
| relative_humidity_1000hPa:p | 92951 | 788 | | | 73.669556 |
| sample_weight | 92951 | 2 | | | 1.23507 |
| sfc_pressure:hPa | 92951 | 902 | | | 1008.107849 |
| snow_depth:cm | 92951 | 165 | | | 0.193203 |
| snow_melt_10min:mm | 92951 | 19 | | | 0.000275 |
| snow_water:kgm2 | 92951 | 42 | | | 0.090324 |
| sun_azimuth:d | 92951 | 69692 | | | 182.386337 |
| sun_elevation:d | 92951 | 49376 | | | -1.207574 |
| super_cooled_liquid_water:kgm2 | 92951 | 15 | | | 0.056944 |
| t_1000hPa:K | 92951 | 447 | | | 279.431091 |
| total_cloud_cover:p | 92951 | 1001 | | | 73.604256 |
| visibility:m | 92951 | 85686 | | | 33027.933594 |
| weekday | 92951 | 7 | | | 3.002184 |
| wind_speed_10m:ms | 92951 | 119 | | | 3.037911 |
| wind_speed_u_10m:ms | 92951 | 188 | | | 0.662565 |
| wind_speed_v_10m:ms | 92951 | 167 | | | 0.6824 |
| wind_speed_w_1000hPa:ms | 92951 | 3 | | | -0.000016 |
| y | 92951 | 12423 | | | 287.232321 |
| year | 92951 | 5 | | | 2020.693193 |

std min 25% \

| | | | |
|---|---|---|---|
| absolute_humidity_2m:gm3 | 2.714546 | 0.5 | 4.0 |
| air_density_2m:kgm3 | 0.036608 | 1.139 | 1.23 |
| ceiling_height_agl:m | 2521.408447 | 27.799999 | 1037.099976 |
| clear_sky_energy_1h:J | 820525.5 | 0.0 | 0.0 |
| clear_sky_rad:W | 228.507324 | 0.0 | 0.0 |
| cloud_base_agl:m | 1790.963745 | 27.4 | 572.200012 |
| dew_or_rime:idx | 0.246032 | -1.0 | 0.0 |
| dew_point_2m:K | 6.83461 | 247.300003 | 270.700012 |
| diffuse_rad:W | 60.647518 | 0.0 | 0.0 |
| diffuse_rad_1h:J | 215907.21875 | 0.0 | 0.0 |
| direct_rad:W | 112.946068 | 0.0 | 0.0 |
| direct_rad_1h:J | 401735.03125 | 0.0 | 0.0 |
| effective_cloud_cover:p | 35.044811 | 0.0 | 41.299999 |
| elevation:m | 7.877236 | 6.0 | 6.0 |
| estimated_diff_hours | 8.935328 | 0.0 | 0.0 |
| fresh_snow_12h:cm | 0.780374 | 0.0 | 0.0 |
| fresh_snow_1h:cm | 0.112621 | 0.0 | 0.0 |
| fresh_snow_24h:cm | 1.218249 | 0.0 | 0.0 |
| fresh_snow_3h:cm | 0.28067 | 0.0 | 0.0 |
| fresh_snow_6h:cm | 0.481389 | 0.0 | 0.0 |
| hour | 6.920153 | 0.0 | 6.0 |
| is_day:idx | 0.499725 | 0.0 | 0.0 |
| is_in_shadow:idx | 0.495709 | 0.0 | 0.0 |
| is_weekend | 0.452258 | 0.0 | 0.0 |
| location | | | |
| month | 3.585604 | 1.0 | 3.0 |
| msl_pressure:hPa | 13.089046 | 944.299988 | 1001.400024 |
| precip_5min:mm | 0.033511 | 0.0 | 0.0 |
| precip_type_5min:idx | 0.384904 | 0.0 | 0.0 |
| pressure_100m:hPa | 13.008334 | 929.799988 | 987.799988 |
| pressure_50m:hPa | 13.067102 | 935.599976 | 993.900024 |
| prob_rime:p | 5.434649 | 0.0 | 0.0 |
| rain_water:kgm2 | 0.042968 | 0.0 | 0.0 |
| relative_humidity_1000hPa:p | 14.328553 | 19.5 | 64.199997 |
| sample_weight | 0.644117 | 1.0 | 1.0 |
| sfc_pressure:hPa | 13.128181 | 941.400024 | 1000.0 |
| snow_depth:cm | 1.254293 | 0.0 | 0.0 |
| snow_melt_10min:mm | 0.004312 | -0.0 | -0.0 |
| snow_water:kgm2 | 0.250991 | 0.0 | 0.0 |
| sun_azimuth:d | 102.913605 | 0.008 | 92.794003 |
| sun_elevation:d | 24.010485 | -49.979 | -18.511 |
| super_cooled_liquid_water:kgm2 | 0.111482 | 0.0 | 0.0 |
| t_1000hPa:K | 6.520342 | 257.899994 | 274.899994 |
| total_cloud_cover:p | 34.993042 | 0.0 | 51.700001 |
| visibility:m | 18319.150391 | 130.600006 | 15798.950195 |
| weekday | 2.001722 | 0.0 | 1.0 |
| wind_speed_10m:ms | 1.778505 | 0.0 | 1.7 |
| wind_speed_u_10m:ms | 2.808995 | -7.3 | -1.4 |

| | | | |
|---|---|---|---|
| wind_speed_v_10m:ms | 1.896996 | -9.3 | -0.6 |
| wind_speed_w_1000hPa:ms | 0.006502 | -0.1 | 0.0 |
| y | 766.670114 | -0.0 | 0.0 |
| year | 1.18587 | 2019.0 | 2020.0 |

| | 50% | 75% | max | \ |
|---|---|---|---|---|
| absolute_humidity_2m:gm3 | 5.4 | 7.8 | 17.5 | |
| air_density_2m:kgm3 | 1.255 | 1.279 | 1.441 | |
| ceiling_height_agl:m | 1803.25 | 3814.824951 | 12431.299805 | |
| clear_sky_energy_1h:J | 4544.899902 | 778247.25 | 3006697.25 | |
| clear_sky_rad:W | 0.0 | 220.949997 | 835.299988 | |
| cloud_base_agl:m | 1128.550049 | 2016.699951 | 11688.900391 | |
| dew_or_rime:idx | 0.0 | 0.0 | 1.0 | |
| dew_point_2m:K | 275.0 | 280.5 | 293.799988 | |
| diffuse_rad:W | 0.0 | 66.0 | 340.100006 | |
| diffuse_rad_1h:J | 9951.700195 | 236502.75 | 1182265.375 | |
| direct_rad:W | 0.0 | 29.0 | 684.299988 | |
| direct_rad_1h:J | 0.0 | 113366.25 | 2445897.0 | |
| effective_cloud_cover:p | 80.800003 | 99.300003 | 100.0 | |
| elevation:m | 7.0 | 24.0 | 24.0 | |
| estimated_diff_hours | 0.0 | 0.0 | 39.0 | |
| fresh_snow_12h:cm | 0.0 | 0.0 | 37.400002 | |
| fresh_snow_1h:cm | 0.0 | 0.0 | 7.1 | |
| fresh_snow_24h:cm | 0.0 | 0.0 | 37.400002 | |
| fresh_snow_3h:cm | 0.0 | 0.0 | 20.6 | |
| fresh_snow_6h:cm | 0.0 | 0.0 | 34.0 | |
| hour | 12.0 | 17.0 | 23.0 | |
| is_day:idx | 0.0 | 1.0 | 1.0 | |
| is_in_shadow:idx | 1.0 | 1.0 | 1.0 | |
| is_weekend | 0.0 | 1.0 | 1.0 | |
| location | | | | |
| month | 6.0 | 10.0 | 12.0 | |
| msl_pressure:hPa | 1010.299988 | 1018.599976 | 1044.099976 | |
| precip_5min:mm | 0.0 | 0.0 | 1.38 | |
| precip_type_5min:idx | 0.0 | 0.0 | 6.0 | |
| pressure_100m:hPa | 996.799988 | 1004.900024 | 1030.900024 | |
| pressure_50m:hPa | 1002.900024 | 1011.099976 | 1037.300049 | |
| prob_rime:p | 0.0 | 0.0 | 97.199997 | |
| rain_water:kgm2 | 0.0 | 0.0 | 1.4 | |
| relative_humidity_1000hPa:p | 76.0 | 85.099998 | 100.0 | |
| sample_weight | 1.0 | 1.0 | 3.0 | |
| sfc_pressure:hPa | 1009.0 | 1017.200012 | 1043.800049 | |
| snow_depth:cm | 0.0 | 0.0 | 18.299999 | |
| snow_melt_10min:mm | 0.0 | -0.0 | 0.18 | |
| snow_water:kgm2 | 0.0 | 0.1 | 6.9 | |
| sun_azimuth:d | 179.526001 | 271.503494 | 359.997009 | |
| sun_elevation:d | -0.99 | 15.538 | 49.917999 | |
| super_cooled_liquid_water:kgm2 | 0.0 | 0.1 | 1.4 | |

| | | | |
|---|---|---|---|
| t_1000hPa:K | 278.700012 | 283.899994 | 303.299988 |
| total_cloud_cover:p | 94.800003 | 100.0 | 100.0 |
| visibility:m | 37350.300781 | 48679.550781 | 76737.796875 |
| weekday | 3.0 | 5.0 | 6.0 |
| wind_speed_10m:ms | 2.7 | 4.1 | 15.2 |
| wind_speed_u_10m:ms | 0.3 | 2.5 | 12.2 |
| wind_speed_v_10m:ms | 0.7 | 1.9 | 9.0 |
| wind_speed_w_1000hPa:ms | 0.0 | 0.0 | 0.1 |
| y | 0.0 | 173.3625 | 5733.42 |
| year | 2021.0 | 2022.0 | 2023.0 |

| | dtypes | missing_count | missing_ratio | raw_type \ |
|---|---|---|---|---|
| absolute_humidity_2m:gm3 | float32 | | | float |
| air_density_2m:kgm3 | float32 | | | float |
| ceiling_height_agl:m | float32 | 20675 | 0.222429 | float |
| clear_sky_energy_1h:J | float32 | | | float |
| clear_sky_rad:W | float32 | | | float |
| cloud_base_agl:m | float32 | 8547 | 0.091952 | float |
| dew_or_rime:idx | float32 | | | float |
| dew_point_2m:K | float32 | | | float |
| diffuse_rad:W | float32 | | | float |
| diffuse_rad_1h:J | float32 | | | float |
| direct_rad:W | float32 | | | float |
| direct_rad_1h:J | float32 | | | float |
| effective_cloud_cover:p | float32 | | | float |
| elevation:m | float32 | | | float |
| estimated_diff_hours | int64 | | | int |
| fresh_snow_12h:cm | float32 | | | float |
| fresh_snow_1h:cm | float32 | | | float |
| fresh_snow_24h:cm | float32 | | | float |
| fresh_snow_3h:cm | float32 | | | float |
| fresh_snow_6h:cm | float32 | | | float |
| hour | int64 | | | int |
| is_day:idx | float32 | | | float |
| is_in_shadow:idx | float32 | | | float |
| is_weekend | int64 | | | int |
| location | object | | | object |
| month | int64 | | | int |
| msl_pressure:hPa | float32 | | | float |
| precip_5min:mm | float32 | | | float |
| precip_type_5min:idx | float32 | | | float |
| pressure_100m:hPa | float32 | | | float |
| pressure_50m:hPa | float32 | | | float |
| prob_rime:p | float32 | | | float |
| rain_water:kgm2 | float32 | | | float |
| relative_humidity_1000hPa:p | float32 | | | float |
| sample_weight | int64 | | | int |
| sfc_pressure:hPa | float32 | | | float |

| | | |
|---|---|---|
| snow_depth:cm | float32 | float |
| snow_melt_10min:mm | float32 | float |
| snow_water:kgm2 | float32 | float |
| sun_azimuth:d | float32 | float |
| sun_elevation:d | float32 | float |
| super_cooled_liquid_water:kgm2 | float32 | float |
| t_1000hPa:K | float32 | float |
| total_cloud_cover:p | float32 | float |
| visibility:m | float32 | float |
| weekday | int64 | int |
| wind_speed_10m:ms | float32 | float |
| wind_speed_u_10m:ms | float32 | float |
| wind_speed_v_10m:ms | float32 | float |
| wind_speed_w_1000hPa:ms | float32 | float |
| y | float64 | float |
| year | int64 | int |

| | variable_type | special_types |
|---|---|---|
| absolute_humidity_2m:gm3 | numeric | |
| air_density_2m:kgm3 | numeric | |
| ceiling_height_agl:m | numeric | |
| clear_sky_energy_1h:J | numeric | |
| clear_sky_rad:W | numeric | |
| cloud_base_agl:m | numeric | |
| dew_or_rime:idx | category | |
| dew_point_2m:K | numeric | |
| diffuse_rad:W | numeric | |
| diffuse_rad_1h:J | numeric | |
| direct_rad:W | numeric | |
| direct_rad_1h:J | numeric | |
| effective_cloud_cover:p | numeric | |
| elevation:m | category | |
| estimated_diff_hours | numeric | |
| fresh_snow_12h:cm | numeric | |
| fresh_snow_1h:cm | numeric | |
| fresh_snow_24h:cm | numeric | |
| fresh_snow_3h:cm | numeric | |
| fresh_snow_6h:cm | numeric | |
| hour | numeric | |
| is_day:idx | category | |
| is_in_shadow:idx | category | |
| is_weekend | category | |
| location | category | |
| month | category | |
| msl_pressure:hPa | numeric | |
| precip_5min:mm | numeric | |
| precip_type_5min:idx | category | |
| pressure_100m:hPa | numeric | |

| | |
|---|---|
| pressure_50m:hPa | numeric |
| prob_rime:p | numeric |
| rain_water:kgm2 | category |
| relative_humidity_1000hPa:p | numeric |
| sample_weight | category |
| sfc_pressure:hPa | numeric |
| snow_depth:cm | numeric |
| snow_melt_10min:mm | category |
| snow_water:kgm2 | numeric |
| sun_azimuth:d | numeric |
| sun_elevation:d | numeric |
| super_cooled_liquid_water:kgm2 | category |
| t_1000hPa:K | numeric |
| total_cloud_cover:p | numeric |
| visibility:m | numeric |
| weekday | category |
| wind_speed_10m:ms | numeric |
| wind_speed_u_10m:ms | numeric |
| wind_speed_v_10m:ms | numeric |
| wind_speed_w_1000hPa:ms | category |
| y | numeric |
| year | category |

**test_data dataset summary**

| | count | unique | top | freq | mean | \ |
|---|---|---|---|---|---|---|
| absolute_humidity_2m:gm3 | 2160 | 106 | | | 8.206482 | |
| air_density_2m:kgm3 | 2160 | 153 | | | 1.232807 | |
| ceiling_height_agl:m | 1473 | 1391 | | | 2938.389648 | |
| clear_sky_energy_1h:J | 2160 | 1807 | | | 1227746.75 | |
| clear_sky_rad:W | 2160 | 1044 | | | 341.056641 | |
| cloud_base_agl:m | 1879 | 1771 | | | 1797.160156 | |
| dew_or_rime:idx | 2160 | 3 | | | 0.040741 | |
| dew_point_2m:K | 2160 | 202 | | | 280.783203 | |
| diffuse_rad:W | 2160 | 985 | | | 84.915688 | |
| diffuse_rad_1h:J | 2160 | 1806 | | | 305696.5 | |
| direct_rad:W | 2160 | 916 | | | 114.279816 | |
| direct_rad_1h:J | 2160 | 1634 | | | 411408.875 | |
| effective_cloud_cover:p | 2160 | 590 | | | 64.113792 | |
| elevation:m | 2160 | 3 | | | 12.333333 | |
| estimated_diff_hours | 2160 | 24 | | | 27.5 | |
| fresh_snow_12h:cm | 2160 | 2 | | | 0.000185 | |
| fresh_snow_1h:cm | 2160 | 2 | | | 0.000185 | |
| fresh_snow_24h:cm | 2160 | 2 | | | 0.000185 | |
| fresh_snow_3h:cm | 2160 | 2 | | | 0.000185 | |
| fresh_snow_6h:cm | 2160 | 2 | | | 0.000185 | |
| hour | 2160 | 24 | | | 11.5 | |
| is_day:idx | 2160 | 2 | | | 0.795833 | |
| is_in_shadow:idx | 2160 | 2 | | | 0.24537 | |

| | | | | | |
|---|---|---|---|---|---|
| is_weekend | 2160 | 2 | | | 0.366667 |
| location | 2160 | 3 | A | 720 | |
| month | 2160 | 3 | | | 5.666667 |
| msl_pressure:hPa | 2160 | 321 | | | 1016.805786 |
| precip_5min:mm | 2160 | 27 | | | 0.00775 |
| precip_type_5min:idx | 2160 | 3 | | | 0.065741 |
| pressure_100m:hPa | 2160 | 359 | | | 1002.970825 |
| pressure_50m:hPa | 2160 | 356 | | | 1009.007202 |
| prob_rime:p | 2160 | 3 | | | 0.01588 |
| rain_water:kgm2 | 2160 | 8 | | | 0.013056 |
| relative_humidity_1000hPa:p | 2160 | 538 | | | 70.920792 |
| sample_weight | 2160 | 1 | | | 3.0 |
| sfc_pressure:hPa | 2160 | 363 | | | 1015.070374 |
| snow_depth:cm | 2160 | 1 | | | 0.0 |
| snow_melt_10min:mm | 2160 | 1 | | | 0.0 |
| snow_water:kgm2 | 2160 | 16 | | | 0.060972 |
| sun_azimuth:d | 2160 | 1830 | | | 183.166199 |
| sun_elevation:d | 2160 | 1623 | | | 20.292332 |
| super_cooled_liquid_water:kgm2 | 2160 | 7 | | | 0.065463 |
| t_1000hPa:K | 2160 | 254 | | | 284.737732 |
| total_cloud_cover:p | 2160 | 553 | | | 69.298981 |
| visibility:m | 2160 | 2155 | | | 33304.636719 |
| weekday | 2160 | 7 | | | 3.233333 |
| wind_speed_10m:ms | 2160 | 83 | | | 2.946759 |
| wind_speed_u_10m:ms | 2160 | 123 | | | 1.650694 |
| wind_speed_v_10m:ms | 2160 | 80 | | | -0.187176 |
| wind_speed_w_1000hPa:ms | 2160 | 2 | | | 0.000324 |
| year | 2160 | 1 | | | 2023.0 |

| | std | min | 25% | \ |
|---|---|---|---|---|
| absolute_humidity_2m:gm3 | 2.201396 | 3.2 | 6.6 | |
| air_density_2m:kgm3 | 0.032116 | 1.142 | 1.209 | |
| ceiling_height_agl:m | 2913.641113 | 30.6 | 891.799988 | |
| clear_sky_energy_1h:J | 1104468.625 | 0.0 | 64338.124023 | |
| clear_sky_rad:W | 307.729095 | 0.0 | 13.65 | |
| cloud_base_agl:m | 2046.394409 | 29.799999 | 486.899994 | |
| dew_or_rime:idx | 0.202365 | -1.0 | 0.0 | |
| dew_point_2m:K | 4.378817 | 268.0 | 277.899994 | |
| diffuse_rad:W | 78.422508 | 0.0 | 6.925 | |
| diffuse_rad_1h:J | 278146.25 | 0.0 | 36756.901367 | |
| direct_rad:W | 171.838226 | 0.0 | 0.0 | |
| direct_rad_1h:J | 611480.125 | 0.0 | 86.575001 | |
| effective_cloud_cover:p | 37.947498 | 0.0 | 30.700001 | |
| elevation:m | 8.261587 | 6.0 | 6.0 | |
| estimated_diff_hours | 6.923789 | 16.0 | 21.75 | |
| fresh_snow_12h:cm | 0.008607 | 0.0 | 0.0 | |
| fresh_snow_1h:cm | 0.008607 | 0.0 | 0.0 | |
| fresh_snow_24h:cm | 0.008607 | 0.0 | 0.0 | |

| | | | |
|---|---|---|---|
| fresh_snow_3h:cm | 0.008607 | 0.0 | 0.0 |
| fresh_snow_6h:cm | 0.008607 | 0.0 | 0.0 |
| hour | 6.923789 | 0.0 | 5.75 |
| is_day:idx | 0.403185 | 0.0 | 1.0 |
| is_in_shadow:idx | 0.430406 | 0.0 | 0.0 |
| is_weekend | 0.482006 | 0.0 | 0.0 |
| location | | | |
| month | 0.596423 | 5.0 | 5.0 |
| msl_pressure:hPa | 9.728754 | 986.099976 | 1011.5 |
| precip_5min:mm | 0.033776 | 0.0 | 0.0 |
| precip_type_5min:idx | 0.249747 | 0.0 | 0.0 |
| pressure_100m:hPa | 9.644145 | 971.799988 | 997.799988 |
| pressure_50m:hPa | 9.74076 | 977.700012 | 1003.799988 |
| prob_rime:p | 0.551282 | 0.0 | 0.0 |
| rain_water:kgm2 | 0.055256 | 0.0 | 0.0 |
| relative_humidity_1000hPa:p | 15.725973 | 23.9 | 60.275 |
| sample_weight | 0.0 | 3.0 | 3.0 |
| sfc_pressure:hPa | 9.840412 | 983.5 | 1009.799988 |
| snow_depth:cm | 0.0 | 0.0 | 0.0 |
| snow_melt_10min:mm | 0.0 | -0.0 | -0.0 |
| snow_water:kgm2 | 0.219562 | 0.0 | 0.0 |
| sun_azimuth:d | 109.193207 | 8.27 | 85.359253 |
| sun_elevation:d | 18.681047 | -11.617 | 1.96475 |
| super_cooled_liquid_water:kgm2 | 0.115824 | 0.0 | 0.0 |
| t_1000hPa:K | 5.839595 | 273.700012 | 279.799988 |
| total_cloud_cover:p | 38.41222 | 0.0 | 32.799999 |
| visibility:m | 15624.633789 | 874.400024 | 19635.100098 |
| weekday | 2.186573 | 0.0 | 1.0 |
| wind_speed_10m:ms | 1.733865 | 0.0 | 1.5 |
| wind_speed_u_10m:ms | 2.578466 | -4.3 | -0.2 |
| wind_speed_v_10m:ms | 1.50826 | -4.4 | -1.3 |
| wind_speed_w_1000hPa:ms | 0.005685 | -0.0 | 0.0 |
| year | 0.0 | 2023.0 | 2023.0 |

| | 50% | 75% | max | \ |
|---|---|---|---|---|
| absolute_humidity_2m:gm3 | 8.0 | 10.0 | 14.2 | |
| air_density_2m:kgm3 | 1.238 | 1.26 | 1.301 | |
| ceiling_height_agl:m | 1553.900024 | 4021.300049 | 11468.0 | |
| clear_sky_energy_1h:J | 1056303.125 | 2372037.5 | 3005707.0 | |
| clear_sky_rad:W | 273.849991 | 646.874985 | 835.099976 | |
| cloud_base_agl:m | 997.799988 | 2298.300049 | 11467.799805 | |
| dew_or_rime:idx | 0.0 | 0.0 | 1.0 | |
| dew_point_2m:K | 281.0 | 284.299988 | 290.200012 | |
| diffuse_rad:W | 73.700001 | 135.600006 | 312.600006 | |
| diffuse_rad_1h:J | 272526.046875 | 488256.03125 | 1086246.25 | |
| direct_rad:W | 16.200001 | 180.399994 | 668.0 | |
| direct_rad_1h:J | 60416.199219 | 686746.859375 | 2403444.25 | |
| effective_cloud_cover:p | 77.75 | 100.0 | 100.0 | |

| | | | |
|---|---|---|---|
| elevation:m | 7.0 | 24.0 | 24.0 |
| estimated_diff_hours | 27.5 | 33.25 | 39.0 |
| fresh_snow_12h:cm | 0.0 | 0.0 | 0.4 |
| fresh_snow_1h:cm | 0.0 | 0.0 | 0.4 |
| fresh_snow_24h:cm | 0.0 | 0.0 | 0.4 |
| fresh_snow_3h:cm | 0.0 | 0.0 | 0.4 |
| fresh_snow_6h:cm | 0.0 | 0.0 | 0.4 |
| hour | 11.5 | 17.25 | 23.0 |
| is_day:idx | 1.0 | 1.0 | 1.0 |
| is_in_shadow:idx | 0.0 | 0.0 | 1.0 |
| is_weekend | 0.0 | 1.0 | 1.0 |
| location | | | |
| month | 6.0 | 6.0 | 7.0 |
| msl_pressure:hPa | 1020.599976 | 1023.799988 | 1029.599976 |
| precip_5min:mm | 0.0 | 0.0 | 0.34 |
| precip_type_5min:idx | 0.0 | 0.0 | 2.0 |
| pressure_100m:hPa | 1006.25 | 1010.099976 | 1016.400024 |
| pressure_50m:hPa | 1012.299988 | 1016.200012 | 1022.5 |
| prob_rime:p | 0.0 | 0.0 | 23.0 |
| rain_water:kgm2 | 0.0 | 0.0 | 0.7 |
| relative_humidity_1000hPa:p | 73.900002 | 83.699997 | 98.900002 |
| sample_weight | 3.0 | 3.0 | 3.0 |
| sfc_pressure:hPa | 1018.299988 | 1022.299988 | 1028.699951 |
| snow_depth:cm | 0.0 | 0.0 | 0.0 |
| snow_melt_10min:mm | 0.0 | 0.0 | 0.0 |
| snow_water:kgm2 | 0.0 | 0.0 | 3.4 |
| sun_azimuth:d | 184.236 | 279.576248 | 356.984009 |
| sun_elevation:d | 18.54 | 38.102499 | 49.902 |
| super_cooled_liquid_water:kgm2 | 0.0 | 0.1 | 0.6 |
| t_1000hPa:K | 284.799988 | 288.299988 | 302.200012 |
| total_cloud_cover:p | 95.300003 | 100.0 | 100.0 |
| visibility:m | 37623.050781 | 45378.099609 | 63863.800781 |
| weekday | 3.0 | 5.0 | 6.0 |
| wind_speed_10m:ms | 2.7 | 4.0 | 8.8 |
| wind_speed_u_10m:ms | 1.6 | 3.525 | 8.8 |
| wind_speed_v_10m:ms | -0.3 | 0.8 | 4.0 |
| wind_speed_w_1000hPa:ms | 0.0 | 0.0 | 0.1 |
| year | 2023.0 | 2023.0 | 2023.0 |

| | dtypes | missing_count | missing_ratio | raw_type \ |
|---|---|---|---|---|
| absolute_humidity_2m:gm3 | float32 | | | float |
| air_density_2m:kgm3 | float32 | | | float |
| ceiling_height_agl:m | float32 | 687 | 0.318056 | float |
| clear_sky_energy_1h:J | float32 | | | float |
| clear_sky_rad:W | float32 | | | float |
| cloud_base_agl:m | float32 | 281 | 0.130093 | float |
| dew_or_rime:idx | float32 | | | float |
| dew_point_2m:K | float32 | | | float |

| | | |
|---|---|---|
| diffuse_rad:W | float32 | float |
| diffuse_rad_1h:J | float32 | float |
| direct_rad:W | float32 | float |
| direct_rad_1h:J | float32 | float |
| effective_cloud_cover:p | float32 | float |
| elevation:m | float32 | float |
| estimated_diff_hours | int64 | int |
| fresh_snow_12h:cm | float32 | float |
| fresh_snow_1h:cm | float32 | float |
| fresh_snow_24h:cm | float32 | float |
| fresh_snow_3h:cm | float32 | float |
| fresh_snow_6h:cm | float32 | float |
| hour | int64 | int |
| is_day:idx | float32 | float |
| is_in_shadow:idx | float32 | float |
| is_weekend | int64 | int |
| location | object | object |
| month | int64 | int |
| msl_pressure:hPa | float32 | float |
| precip_5min:mm | float32 | float |
| precip_type_5min:idx | float32 | float |
| pressure_100m:hPa | float32 | float |
| pressure_50m:hPa | float32 | float |
| prob_rime:p | float32 | float |
| rain_water:kgm2 | float32 | float |
| relative_humidity_1000hPa:p | float32 | float |
| sample_weight | int64 | int |
| sfc_pressure:hPa | float32 | float |
| snow_depth:cm | float32 | float |
| snow_melt_10min:mm | float32 | float |
| snow_water:kgm2 | float32 | float |
| sun_azimuth:d | float32 | float |
| sun_elevation:d | float32 | float |
| super_cooled_liquid_water:kgm2 | float32 | float |
| t_1000hPa:K | float32 | float |
| total_cloud_cover:p | float32 | float |
| visibility:m | float32 | float |
| weekday | int64 | int |
| wind_speed_10m:ms | float32 | float |
| wind_speed_u_10m:ms | float32 | float |
| wind_speed_v_10m:ms | float32 | float |
| wind_speed_w_1000hPa:ms | float32 | float |
| year | int64 | int |

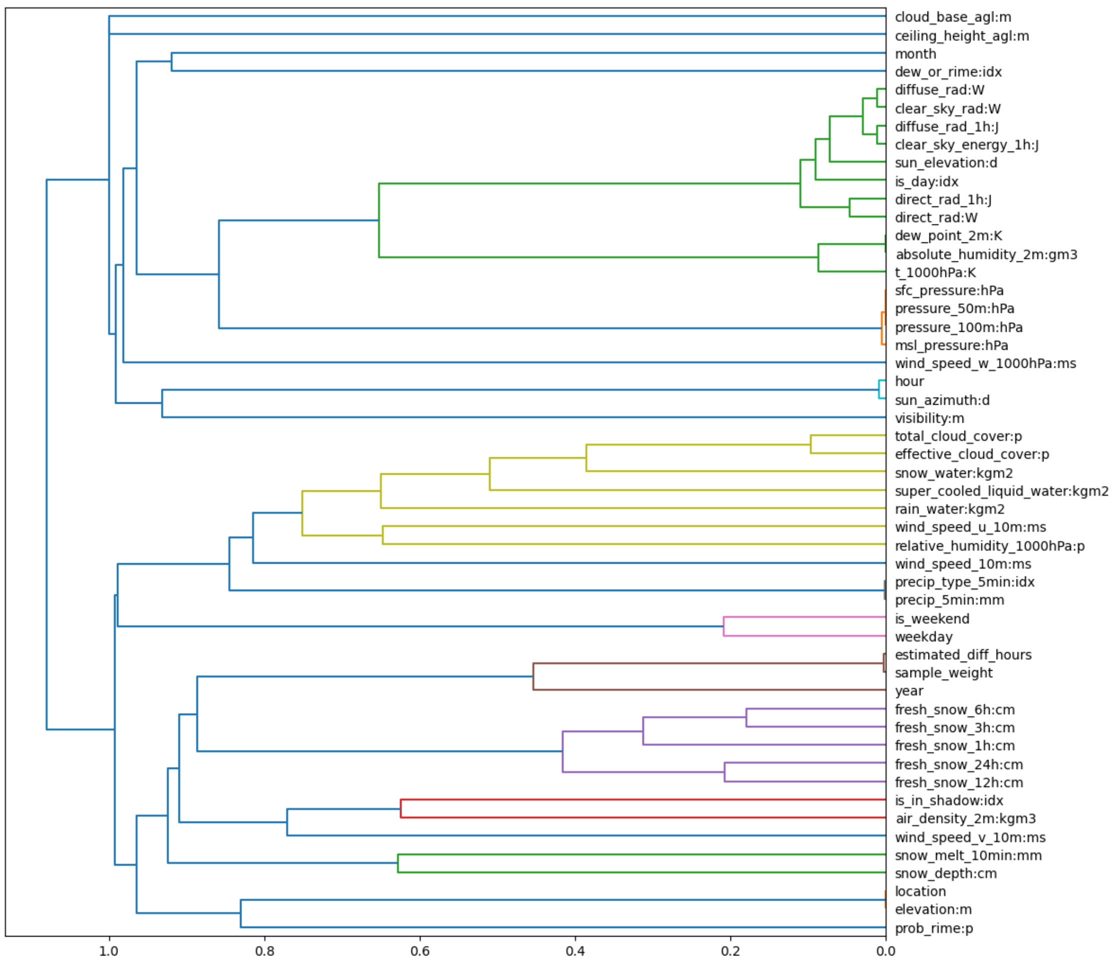
| | variable_type | special_types |
|---|---|---|
| absolute_humidity_2m:gm3 | numeric | |
| air_density_2m:kgm3 | numeric | |
| ceiling_height_agl:m | numeric | |

| | |
|---|---|
| clear_sky_energy_1h:J | numeric |
| clear_sky_rad:W | numeric |
| cloud_base_agl:m | numeric |
| dew_or_rime:idx | category |
| dew_point_2m:K | numeric |
| diffuse_rad:W | numeric |
| diffuse_rad_1h:J | numeric |
| direct_rad:W | numeric |
| direct_rad_1h:J | numeric |
| effective_cloud_cover:p | numeric |
| elevation:m | category |
| estimated_diff_hours | numeric |
| fresh_snow_12h:cm | category |
| fresh_snow_1h:cm | category |
| fresh_snow_24h:cm | category |
| fresh_snow_3h:cm | category |
| fresh_snow_6h:cm | category |
| hour | numeric |
| is_day:idx | category |
| is_in_shadow:idx | category |
| is_weekend | category |
| location | category |
| month | category |
| msl_pressure:hPa | numeric |
| precip_5min:mm | numeric |
| precip_type_5min:idx | category |
| pressure_100m:hPa | numeric |
| pressure_50m:hPa | numeric |
| prob_rime:p | category |
| rain_water:kgm2 | category |
| relative_humidity_1000hPa:p | numeric |
| sample_weight | category |
| sfc_pressure:hPa | numeric |
| snow_depth:cm | category |
| snow_melt_10min:mm | category |
| snow_water:kgm2 | category |
| sun_azimuth:d | numeric |
| sun_elevation:d | numeric |
| super_cooled_liquid_water:kgm2 | category |
| t_1000hPa:K | numeric |
| total_cloud_cover:p | numeric |
| visibility:m | numeric |
| weekday | category |
| wind_speed_10m:ms | numeric |
| wind_speed_u_10m:ms | numeric |
| wind_speed_v_10m:ms | numeric |
| wind_speed_w_1000hPa:ms | category |
| year | category |

**Types warnings summary**

| | train_data | test_data | warnings |
|---|---|---|---|
| y | float | -- | warning |

### 1.0.1 Feature Distance

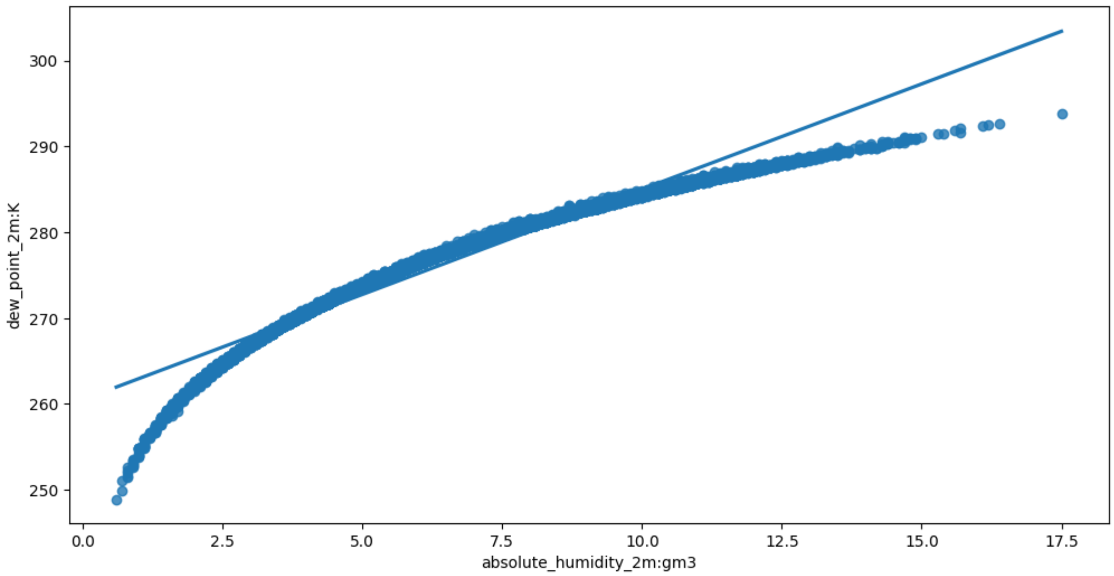



**The following feature groups are considered as near-duplicates**:

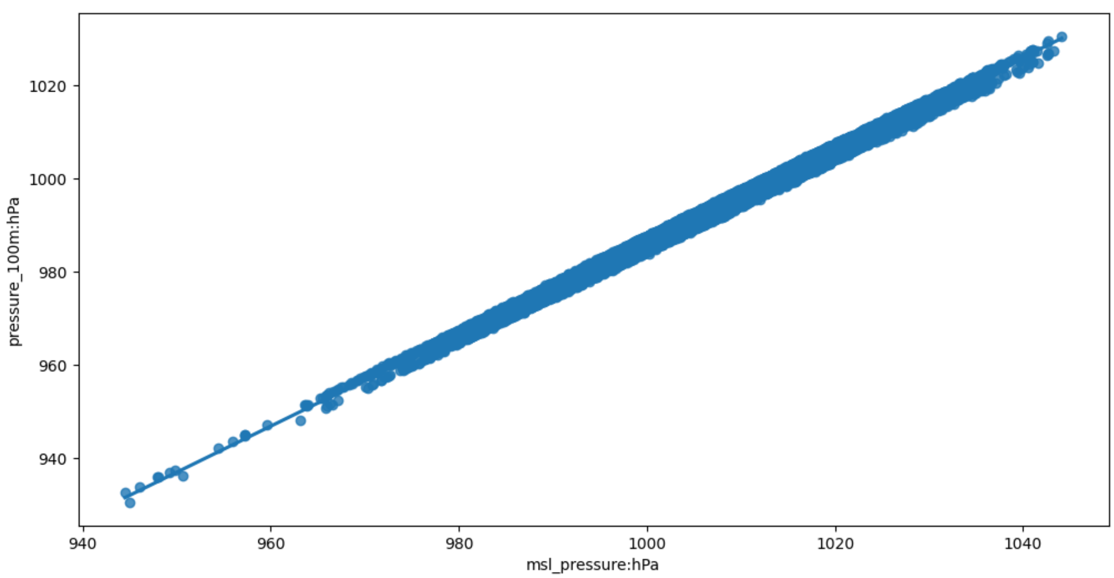
Distance threshold: <= `0.01`. Consider keeping only some of the columns within each group:

- `elevation:m`, `location` - distance `0.00`
- `absolute_humidity_2m:gm3`, `dew_point_2m:K` - distance `0.00`
- `precip_5min:mm`, `precip_type_5min:idx` - distance `0.00`
- `estimated_diff_hours`, `sample_weight` - distance `0.00`
- `msl_pressure:hPa`, `pressure_100m:hPa`, `pressure_50m:hPa`, `sfc_pressure:hPa` - distance `0.00`
- `hour`, `sun_azimuth:d` - distance `0.01`

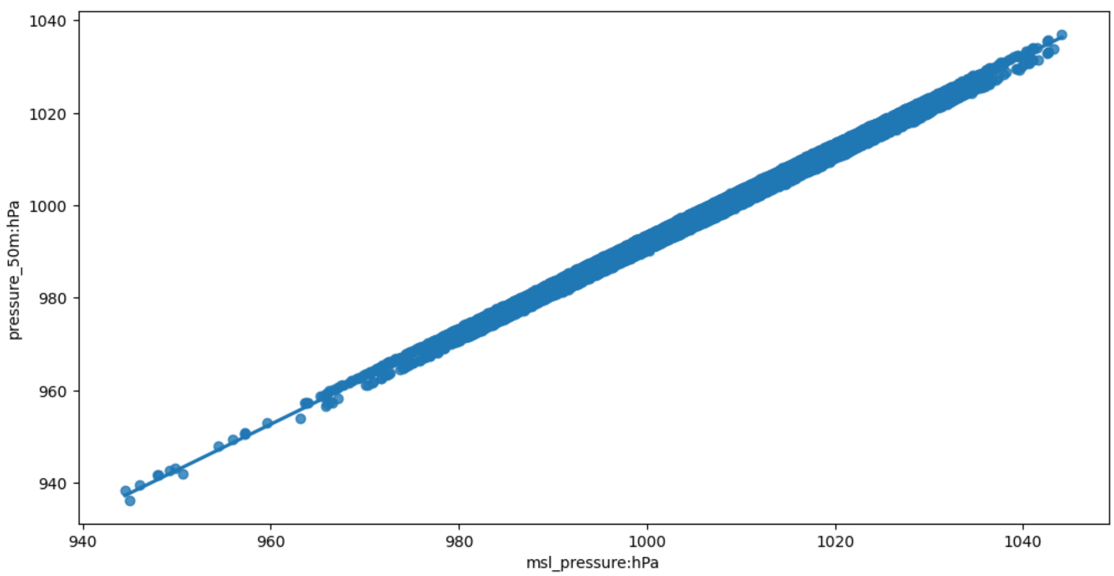
Feature interaction between `absolute_humidity_2m:gm3`/`dew_point_2m:K`



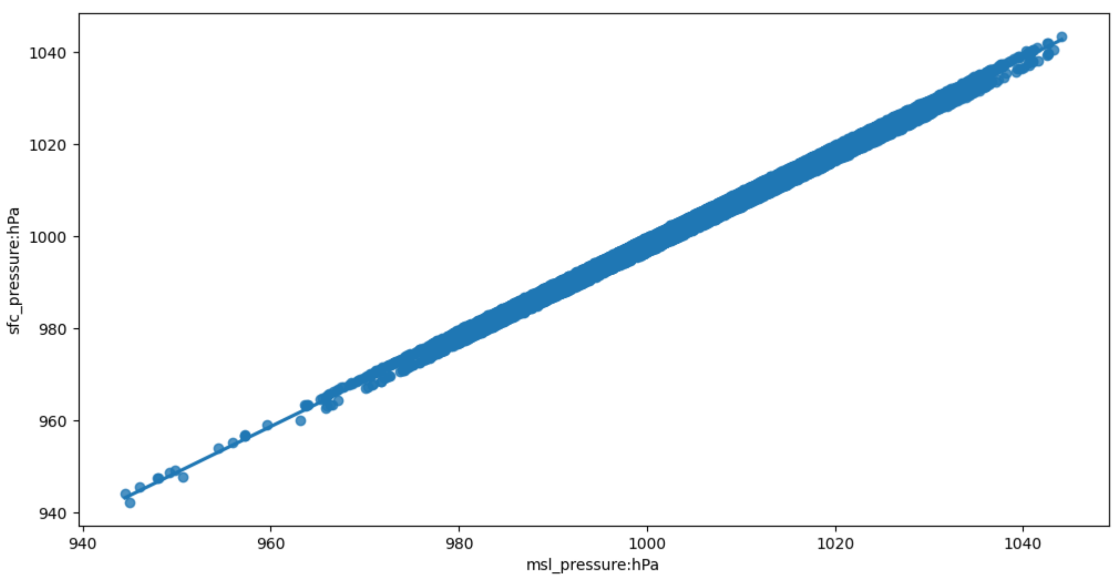

Feature interaction between `msl_pressure:hPa/pressure_100m:hPa`



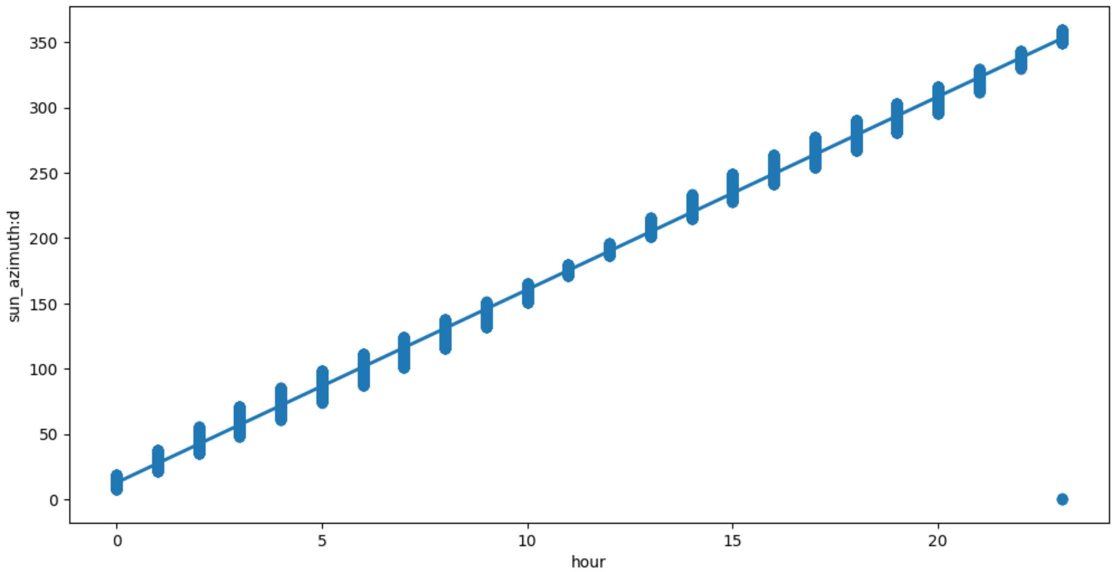

Feature interaction between `msl_pressure:hPa/pressure_50m:hPa`




Feature interaction between `msl_pressure:hPa`/`sfc_pressure:hPa`




Feature interaction between `hour`/`sun_azimuth:d`

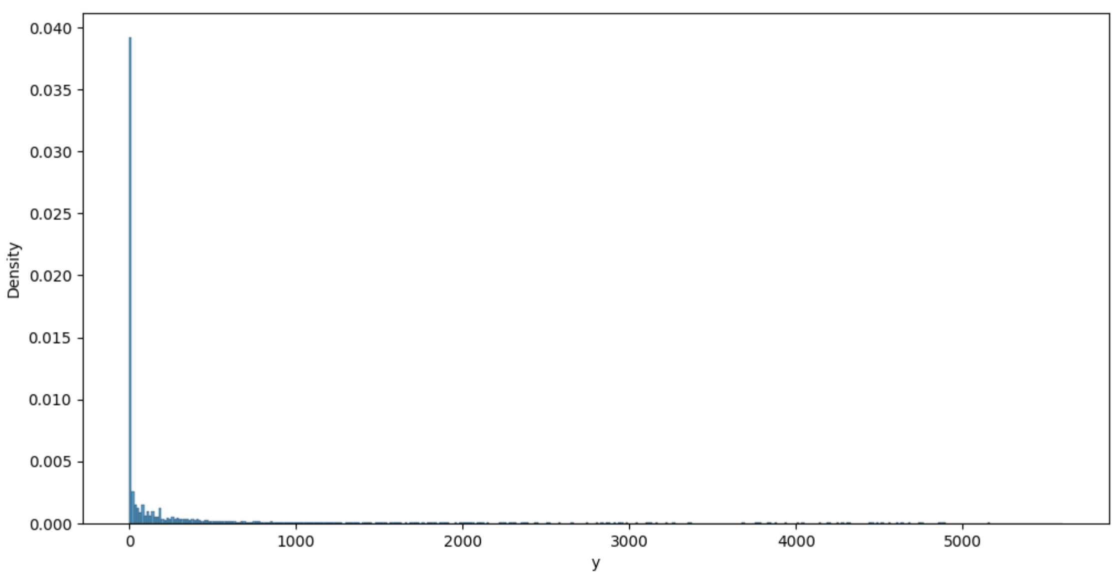



[99]:
```
auto.target_analysis(train_data=X_train, label="y")
```

## 1.1 Target variable analysis

```
   count        mean          std  min  25%  50%         75%      max   dtypes  \
y  10000  285.096363  774.286536 -0.0  0.0  0.0  160.566251  5596.36  float64

   unique missing_count missing_ratio raw_type special_types
y    2523                                float
```

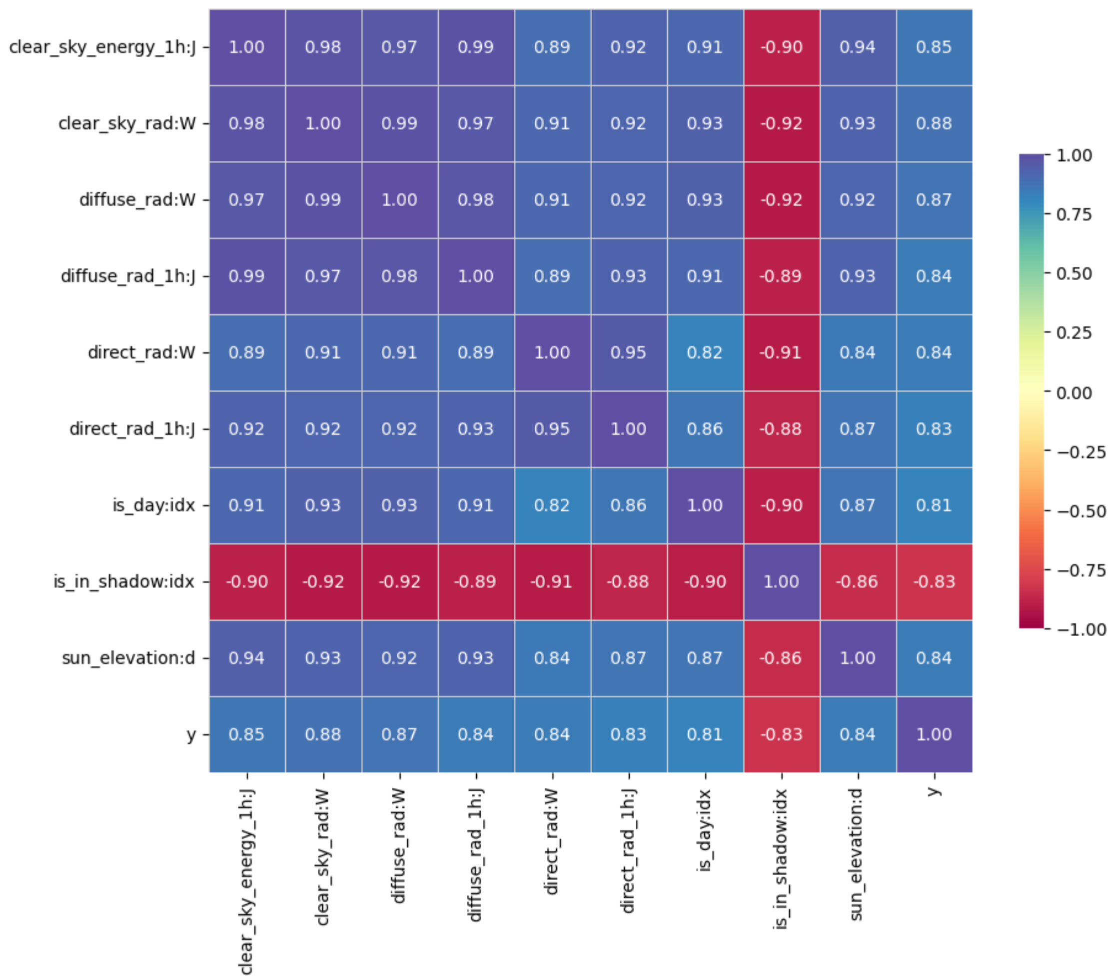


### 1.1.1 Distribution fits for target variable

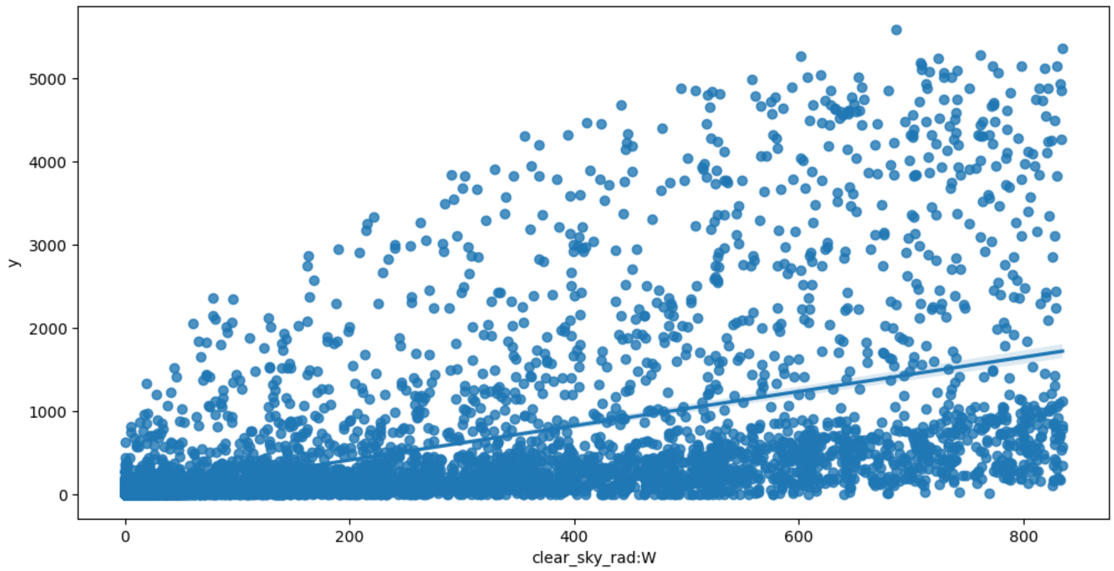
- none of the attempted distribution fits satisfy specified minimum p-value threshold: `0.01`

### 1.1.2 Target variable correlations

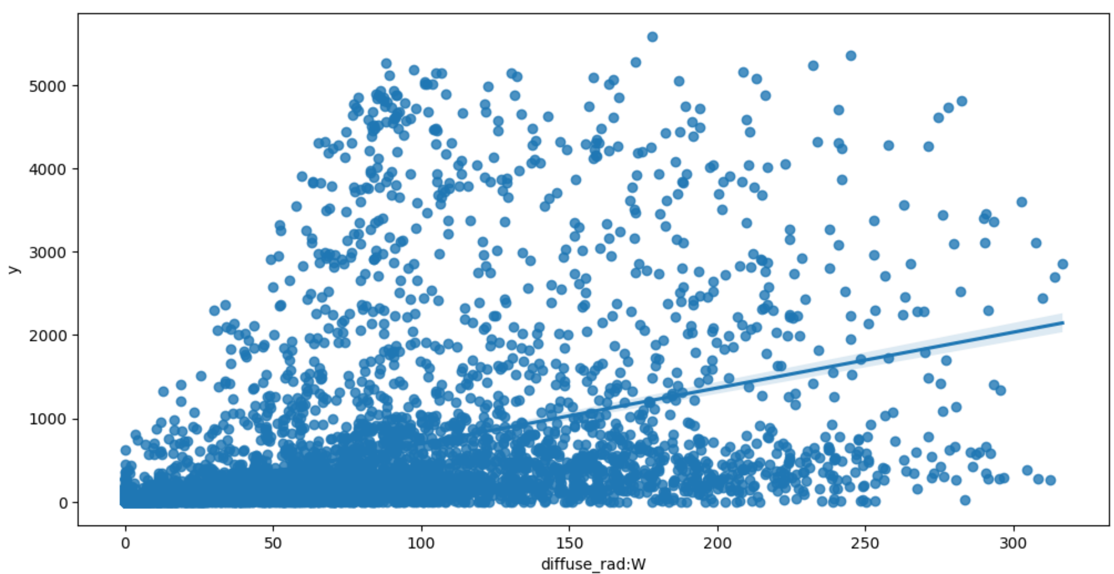
**`train_data` - spearman correlation matrix; focus: absolute correlation for `y` >= `0.5` (sample size: 10000)**



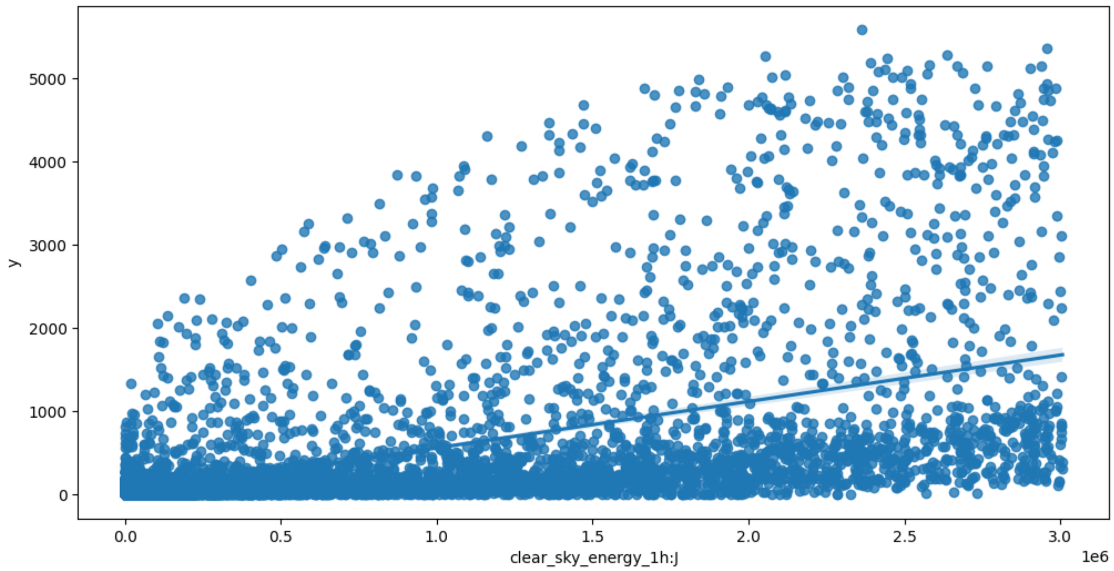

**Feature interaction between `clear_sky_rad:W`/`y` in `train_data` (sample size: 10000)**



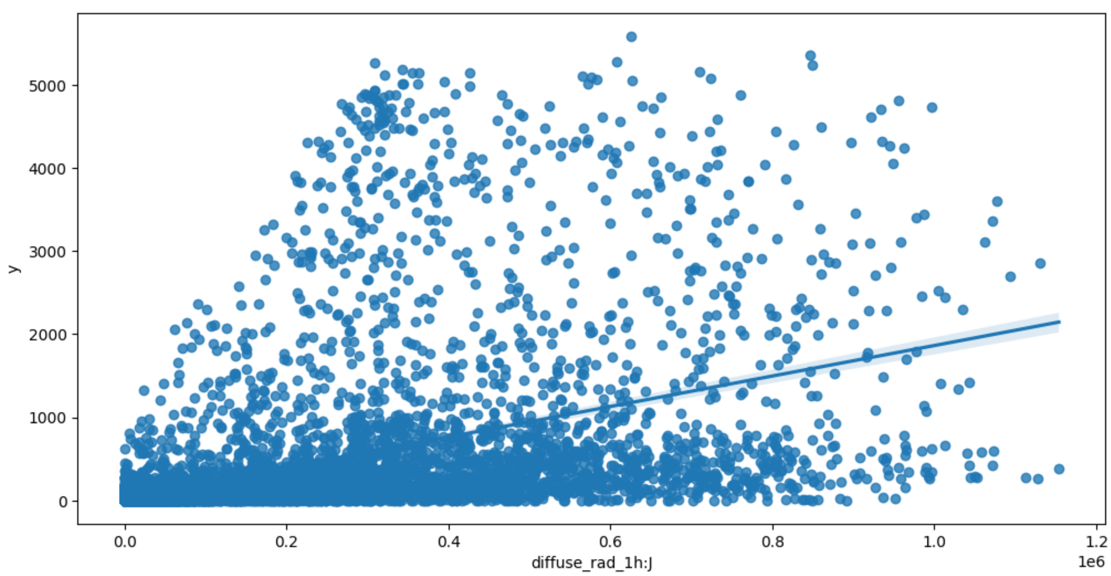

**Feature interaction between `diffuse_rad:W`/`y` in `train_data` (sample size: 10000)**



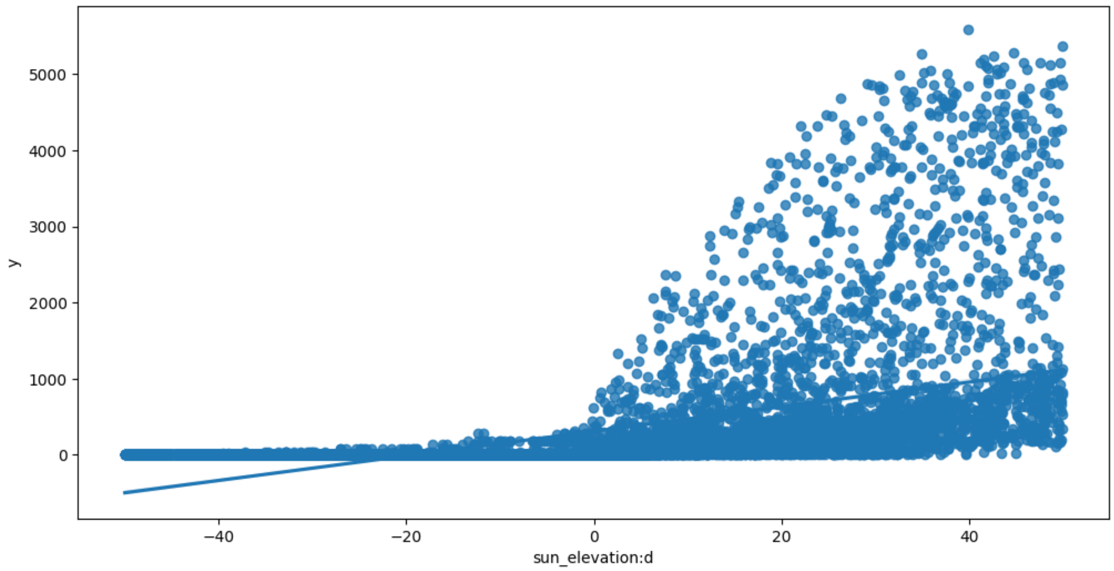

**Feature interaction between `clear_sky_energy_1h:J`/`y` in `train_data` (sample size: 10000)**



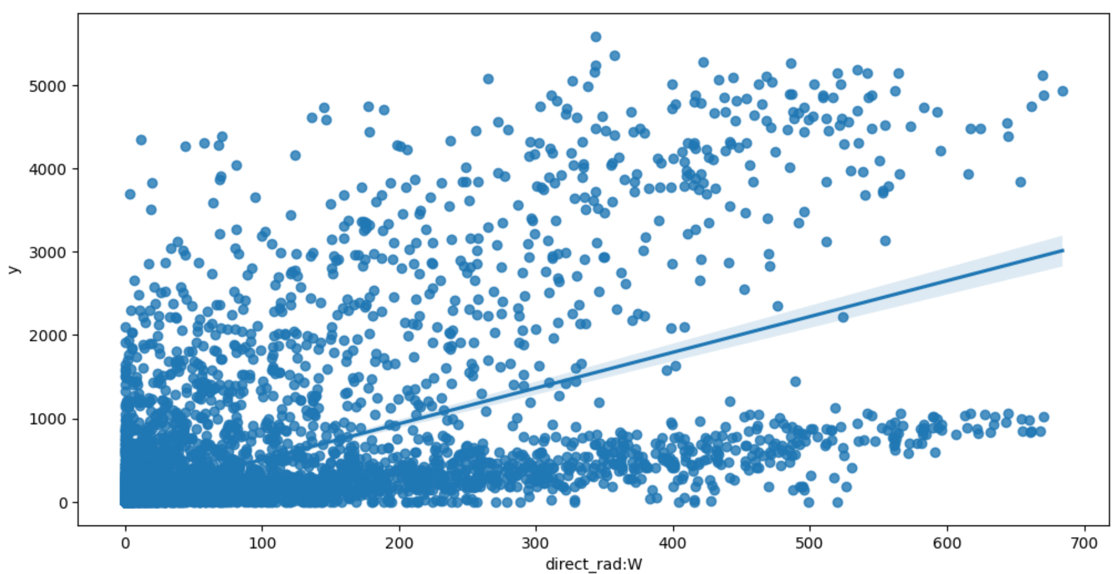

**Feature interaction between `diffuse_rad_1h:J/y` in `train_data` (sample size: 10000)**



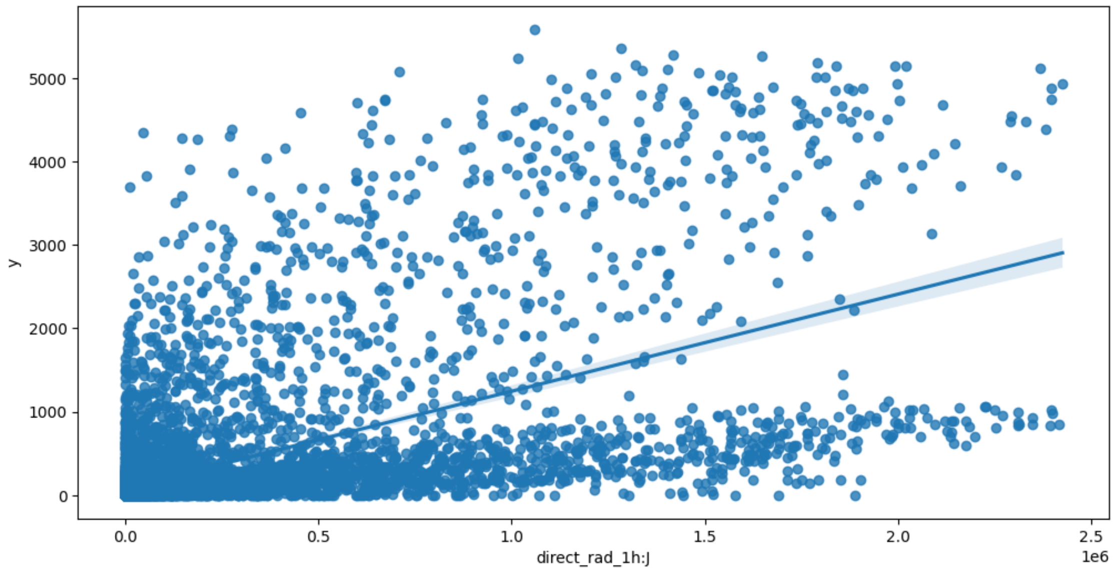

**Feature interaction between `sun_elevation:d/y` in `train_data` (sample size: 10000)**



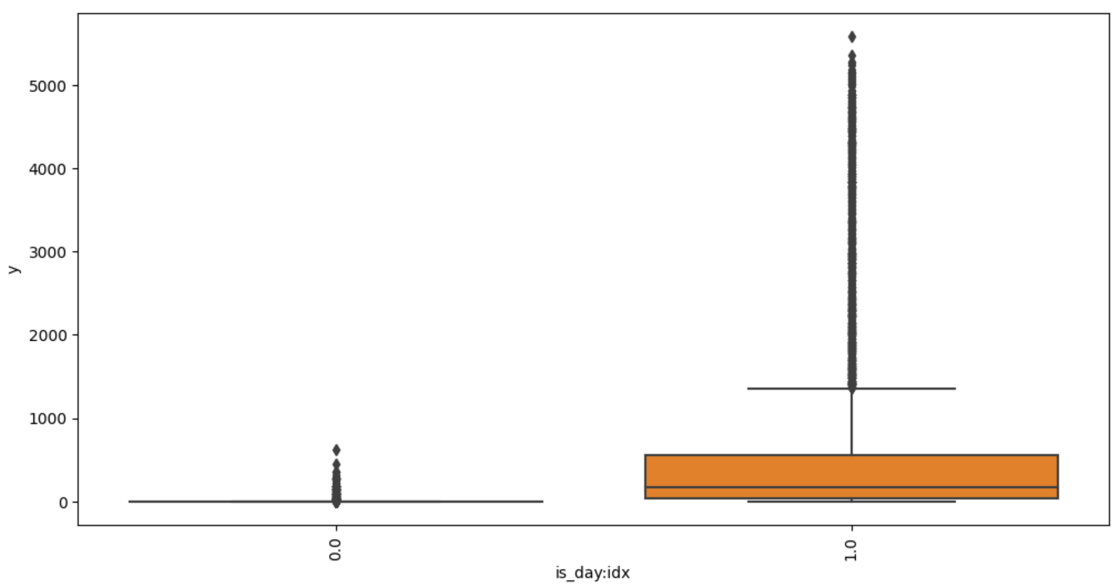

**Feature interaction between `direct_rad:W/y` in `train_data` (sample size: 10000)**



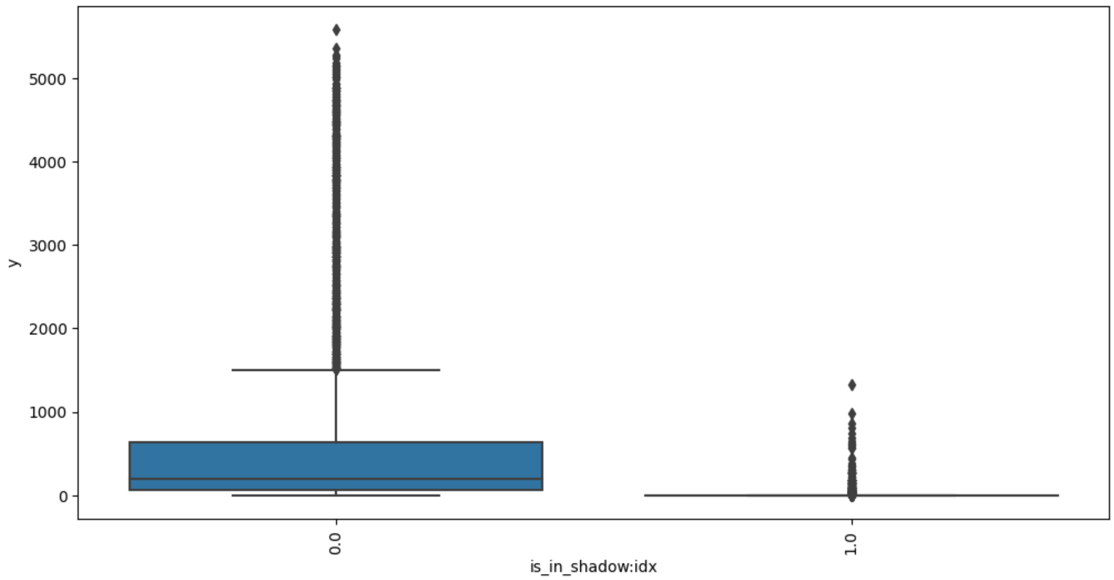

**Feature interaction between `direct_rad_1h:J/y` in `train_data` (sample size: 10000)**




**Feature interaction between `is_day:idx`/y in `train_data` (sample size: 10000)**




**Feature interaction between `is_in_shadow:idx`/y in `train_data` (sample size: 10000)**




## 2 Starting

[100]:
```
import os


# Get the last submission number
last_submission_number = int(max([int(filename.split('_')[1].split('.')[0]) for␣
↪filename in os.listdir('submissions') if "submission" in filename]))
print("Last submission number:", last_submission_number)
print("Now creating submission number:", last_submission_number + 1)

# Create the new filename
new_filename = f'submission_{last_submission_number + 1}'

hello = os.environ.get('HELLO')
if hello is not None:
    new_filename += f'_{hello}'

print("New filename:", new_filename)
```

```
Last submission number: 78
Now creating submission number: 79
New filename: submission_79_jorge
```

[101]:
```
from autogluon.tabular import TabularDataset, TabularPredictor
train_data = TabularDataset('X_train_raw.csv')
train_data.drop(columns=['ds'], inplace=True)
```

```
label = 'y'
metric = 'mean_absolute_error'
time_limit = 60
presets = 'best_quality'

sample_weight = 'sample_weight' #None
weight_evaluation = True #False
```

```
Loaded data from: X_train_raw.csv | Columns = 53 / 53 | Rows = 92951 -> 92951
```

[102]:
```
predictors = [None, None, None]
```

[103]:
```
loc = "A"
print(f"Training model for location {loc}...")
predictor = TabularPredictor(label=label, eval_metric=metric,␣
 ↪path=f"AutogluonModels/{new_filename}_{loc}", sample_weight=sample_weight,␣
 ↪weight_evaluation=weight_evaluation).fit(train_data[train_data["location"]␣
 ↪== loc], time_limit=time_limit, presets=presets)
predictors[0] = predictor
```

```
Warning: path already exists! This predictor may overwrite an existing
predictor! path="AutogluonModels/submission_79_jorge_A"
Presets specified: ['best_quality']
Stack configuration (auto_stack=True): num_stack_levels=1, num_bag_folds=8,
num_bag_sets=20
Values in column 'sample_weight' used as sample weights instead of predictive
features. Evaluation will report weighted metrics, so ensure same column exists
in test data.
Beginning AutoGluon training … Time limit = 60s
AutoGluon will save models to "AutogluonModels/submission_79_jorge_A/"
AutoGluon Version:  0.8.1
Python Version:     3.10.12
Operating System:   Darwin
Platform Machine:   arm64
Platform Version:   Darwin Kernel Version 22.1.0: Sun Oct  9 20:15:09 PDT 2022;
root:xnu-8792.41.9~2/RELEASE_ARM64_T6000
Disk Space Avail:   15.33 GB / 494.38 GB (3.1%)
Train Data Rows:    34061
Train Data Columns: 51
Label Column: y
Preprocessing data …
AutoGluon infers your prediction problem is: 'regression' (because dtype of
label-column == float and many unique label-values observed).
        Label info (max, min, mean, stddev): (5733.42, 0.0, 631.01116,
1166.20607)
        If 'regression' is not the correct problem_type, please manually specify
the problem_type parameter during predictor init (You may specify problem_type
```

```
as one of: ['binary', 'multiclass', 'regression'])
Using Feature Generators to preprocess the data …
Fitting AutoMLPipelineFeatureGenerator…
        Available Memory:                    5038.42 MB
        Train Data (Original)  Memory Usage: 15.33 MB (0.3% of available memory)
        Inferring data type of each feature based on column values. Set
feature_metadata_in to manually specify special dtypes of the features.
        Stage 1 Generators:
                Fitting AsTypeFeatureGenerator…
                        Note: Converting 4 features to boolean dtype as they
only contain 2 unique values.
        Stage 2 Generators:
                Fitting FillNaFeatureGenerator…
        Stage 3 Generators:
                Fitting IdentityFeatureGenerator…
        Stage 4 Generators:
                Fitting DropUniqueFeatureGenerator…
        Stage 5 Generators:
                Fitting DropDuplicatesFeatureGenerator…
        Useless Original Features (Count: 2): ['elevation:m', 'location']
                These features carry no predictive signal and should be manually
investigated.
                This is typically a feature which has the same value for all
rows.
                These features do not need to be present at inference time.
        Types of features in original data (raw dtype, special dtypes):
                ('float', []) : 42 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])   :  6 | ['estimated_diff_hours', 'hour', 'weekday',
'is_weekend', 'month', …]
        Types of features in processed data (raw dtype, special dtypes):
                ('float', [])     : 39 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])       :  5 | ['estimated_diff_hours', 'hour',
'weekday', 'month', 'year']
                ('int', ['bool']) :  4 | ['is_day:idx', 'is_in_shadow:idx',
'wind_speed_w_1000hPa:ms', 'is_weekend']
        0.1s = Fit runtime
        48 features in original data used to generate 48 features in processed
data.
        Train Data (Processed) Memory Usage: 12.13 MB (0.2% of available memory)
Data preprocessing and feature engineering runtime = 0.11s …
AutoGluon will gauge predictive performance using evaluation metric:
'mean_absolute_error'
        This metric's sign has been flipped to adhere to being higher_is_better.
The metric score can be multiplied by -1 to get the metric value.
```

```
        To change this, specify the eval_metric parameter of Predictor()
User-specified model hyperparameters to be fit:
{
        'NN_TORCH': {},
        'GBM': [{'extra_trees': True, 'ag_args': {'name_suffix': 'XT'}}, {},
'GBMLarge'],
        'CAT': {},
        'XGB': {},
        'FASTAI': {},
        'RF': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'XT': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'KNN': [{'weights': 'uniform', 'ag_args': {'name_suffix': 'Unif'}},
{'weights': 'distance', 'ag_args': {'name_suffix': 'Dist'}}],
}
AutoGluon will fit 2 stack levels (L1 to L2) …
Fitting 11 L1 models …
Fitting model: KNeighborsUnif_BAG_L1 … Training model for up to 39.91s of the
59.88s of remaining time.

Training model for location A…

        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 216.28s compared to 51.86s of available time.
        Time limit exceeded… Skipping KNeighborsUnif_BAG_L1.
Fitting model: KNeighborsDist_BAG_L1 … Training model for up to 36.69s of the
56.65s of remaining time.
        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 171.61s compared to 47.67s of available time.
        Time limit exceeded… Skipping KNeighborsDist_BAG_L1.
Fitting model: LightGBMXT_BAG_L1 … Training model for up to 34.12s of the
54.09s of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
```

[ ]:
```
loc = "B"
print(f"Training model for location {loc}...")
predictor = TabularPredictor(label=label, eval_metric=metric,␣
 ↪path=f"AutogluonModels/{new_filename}_{loc}", sample_weight=sample_weight,␣
 ↪weight_evaluation=weight_evaluation).fit(train_data[train_data["location"]␣
 ↪== loc], time_limit=time_limit, presets=presets)
```

```
predictors[1] = predictor
```

```
Warning: path already exists! This predictor may overwrite an existing
predictor! path="AutogluonModels/submission_79_jorge_B"
Presets specified: ['best_quality']
Stack configuration (auto_stack=True): num_stack_levels=1, num_bag_folds=8,
num_bag_sets=20
Values in column 'sample_weight' used as sample weights instead of predictive
features. Evaluation will report weighted metrics, so ensure same column exists
in test data.
Beginning AutoGluon training … Time limit = 60s
AutoGluon will save models to "AutogluonModels/submission_79_jorge_B/"
AutoGluon Version:  0.8.1
Python Version:     3.10.12
Operating System:   Darwin
Platform Machine:   arm64
Platform Version:   Darwin Kernel Version 22.1.0: Sun Oct  9 20:15:09 PDT 2022;
root:xnu-8792.41.9~2/RELEASE_ARM64_T6000
Disk Space Avail:   15.97 GB / 494.38 GB (3.2%)
Train Data Rows:    32819
Train Data Columns: 51
Label Column: y
Preprocessing data …
AutoGluon infers your prediction problem is: 'regression' (because dtype of
label-column == float and many unique label-values observed).
        Label info (max, min, mean, stddev): (1152.3, -0.0, 96.89334, 194.00409)
        If 'regression' is not the correct problem_type, please manually specify
the problem_type parameter during predictor init (You may specify problem_type
as one of: ['binary', 'multiclass', 'regression'])
Using Feature Generators to preprocess the data …
Fitting AutoMLPipelineFeatureGenerator…
        Available Memory:                    4394.88 MB
        Train Data (Original)  Memory Usage: 14.77 MB (0.3% of available memory)
        Inferring data type of each feature based on column values. Set
feature_metadata_in to manually specify special dtypes of the features.
        Stage 1 Generators:
                Fitting AsTypeFeatureGenerator…
                        Note: Converting 4 features to boolean dtype as they
only contain 2 unique values.
        Stage 2 Generators:
                Fitting FillNaFeatureGenerator…
        Stage 3 Generators:
                Fitting IdentityFeatureGenerator…
        Stage 4 Generators:
                Fitting DropUniqueFeatureGenerator…
        Stage 5 Generators:
                Fitting DropDuplicatesFeatureGenerator…
        Useless Original Features (Count: 2): ['elevation:m', 'location']
```

```
                These features carry no predictive signal and should be manually
investigated.
                This is typically a feature which has the same value for all
rows.
                These features do not need to be present at inference time.
        Types of features in original data (raw dtype, special dtypes):
                ('float', []) : 42 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])   :  6 | ['estimated_diff_hours', 'hour', 'weekday',
'is_weekend', 'month', …]
        Types of features in processed data (raw dtype, special dtypes):
                ('float', [])     : 39 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])       :  5 | ['estimated_diff_hours', 'hour',
'weekday', 'month', 'year']
                ('int', ['bool']) :  4 | ['is_day:idx', 'is_in_shadow:idx',
'wind_speed_w_1000hPa:ms', 'is_weekend']
        0.1s = Fit runtime
        48 features in original data used to generate 48 features in processed
data.
        Train Data (Processed) Memory Usage: 11.68 MB (0.3% of available memory)
Data preprocessing and feature engineering runtime = 0.16s …
AutoGluon will gauge predictive performance using evaluation metric:
'mean_absolute_error'
        This metric's sign has been flipped to adhere to being higher_is_better.
The metric score can be multiplied by -1 to get the metric value.
        To change this, specify the eval_metric parameter of Predictor()
User-specified model hyperparameters to be fit:
{
        'NN_TORCH': {},
        'GBM': [{'extra_trees': True, 'ag_args': {'name_suffix': 'XT'}}, {},
'GBMLarge'],
        'CAT': {},
        'XGB': {},
        'FASTAI': {},
        'RF': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'XT': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'KNN': [{'weights': 'uniform', 'ag_args': {'name_suffix': 'Unif'}},
```

```
{'weights': 'distance', 'ag_args': {'name_suffix': 'Dist'}}],
}
AutoGluon will fit 2 stack levels (L1 to L2) …
Fitting 11 L1 models …
Fitting model: KNeighborsUnif_BAG_L1 … Training model for up to 39.88s of the
59.84s of remaining time.

Training model for location B…

        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 160.16s compared to 51.82s of available time.
        Time limit exceeded… Skipping KNeighborsUnif_BAG_L1.
Fitting model: KNeighborsDist_BAG_L1 … Training model for up to 37.4s of the
57.35s of remaining time.
        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 133.14s compared to 48.59s of available time.
        Time limit exceeded… Skipping KNeighborsDist_BAG_L1.
Fitting model: LightGBMXT_BAG_L1 … Training model for up to 35.32s of the
55.28s of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -23.1587         = Validation score   (-mean_absolute_error)
        24.39s   = Training   runtime
        65.15s   = Validation runtime
Fitting model: LightGBM_BAG_L1 … Training model for up to 0.11s of the 20.06s
of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -116.8768        = Validation score   (-mean_absolute_error)
        1.21s    = Training   runtime
        0.02s    = Validation runtime
Completed 1/20 k-fold bagging repeats …
Fitting model: WeightedEnsemble_L2 … Training model for up to 59.84s of the
16.45s of remaining time.
        -23.1587         = Validation score   (-mean_absolute_error)
        0.12s    = Training   runtime
        0.0s     = Validation runtime
Fitting 9 L2 models …
Fitting model: LightGBMXT_BAG_L2 … Training model for up to 16.32s of the
16.3s of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -21.9002         = Validation score   (-mean_absolute_error)
        3.87s    = Training   runtime
        1.0s     = Validation runtime
Fitting model: LightGBM_BAG_L2 … Training model for up to 10.01s of the 10.0s
of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
```

```
        -21.3768         = Validation score   (-mean_absolute_error)
        1.57s    = Training   runtime
        0.18s    = Validation runtime
Fitting model: RandomForestMSE_BAG_L2 … Training model for up to 6.63s of the
6.62s of remaining time.
        -20.3273         = Validation score   (-mean_absolute_error)
        25.22s   = Training   runtime
        0.86s    = Validation runtime
Completed 1/20 k-fold bagging repeats …
Fitting model: WeightedEnsemble_L3 … Training model for up to 59.84s of the
-19.69s of remaining time.
        -20.3273         = Validation score   (-mean_absolute_error)
        0.2s     = Training   runtime
        0.0s     = Validation runtime
AutoGluon training complete, total runtime = 79.91s … Best model:
"WeightedEnsemble_L3"
TabularPredictor saved. To load, use: predictor =
TabularPredictor.load("AutogluonModels/submission_79_jorge_B/")
```

[ ]:
```
loc = "C"
print(f"Training model for location {loc}...")
predictor = TabularPredictor(label=label, eval_metric=metric,␣
 ↪path=f"AutogluonModels/{new_filename}_{loc}", sample_weight=sample_weight,␣
 ↪weight_evaluation=weight_evaluation).fit(train_data[train_data["location"]␣
 ↪== loc], time_limit=time_limit, presets=presets)
predictors[2] = predictor
```

```
Warning: path already exists! This predictor may overwrite an existing
predictor! path="AutogluonModels/submission_79_jorge_C"
Presets specified: ['best_quality']
Stack configuration (auto_stack=True): num_stack_levels=1, num_bag_folds=8,
num_bag_sets=20
Values in column 'sample_weight' used as sample weights instead of predictive
features. Evaluation will report weighted metrics, so ensure same column exists
in test data.
Beginning AutoGluon training … Time limit = 60s
AutoGluon will save models to "AutogluonModels/submission_79_jorge_C/"
AutoGluon Version:  0.8.1
Python Version:     3.10.12
Operating System:   Darwin
Platform Machine:   arm64
Platform Version:   Darwin Kernel Version 22.1.0: Sun Oct  9 20:15:09 PDT 2022;
root:xnu-8792.41.9~2/RELEASE_ARM64_T6000
Disk Space Avail:   15.55 GB / 494.38 GB (3.1%)
Train Data Rows:    26071
Train Data Columns: 51
Label Column: y
Preprocessing data …
```

```
AutoGluon infers your prediction problem is: 'regression' (because dtype of
label-column == float and label-values can't be converted to int).
        Label info (max, min, mean, stddev): (999.6, -0.0, 77.70004, 165.87752)
        If 'regression' is not the correct problem_type, please manually specify
the problem_type parameter during predictor init (You may specify problem_type
as one of: ['binary', 'multiclass', 'regression'])
Using Feature Generators to preprocess the data …
Fitting AutoMLPipelineFeatureGenerator…
        Available Memory:                    4399.47 MB
        Train Data (Original)  Memory Usage: 11.73 MB (0.3% of available memory)
        Inferring data type of each feature based on column values. Set
feature_metadata_in to manually specify special dtypes of the features.
        Stage 1 Generators:
                Fitting AsTypeFeatureGenerator…
                        Note: Converting 3 features to boolean dtype as they
only contain 2 unique values.
        Stage 2 Generators:
                Fitting FillNaFeatureGenerator…
        Stage 3 Generators:
                Fitting IdentityFeatureGenerator…
        Stage 4 Generators:
                Fitting DropUniqueFeatureGenerator…
        Stage 5 Generators:
                Fitting DropDuplicatesFeatureGenerator…
        Useless Original Features (Count: 2): ['elevation:m', 'location']
                These features carry no predictive signal and should be manually
investigated.
                This is typically a feature which has the same value for all
rows.
                These features do not need to be present at inference time.
        Types of features in original data (raw dtype, special dtypes):
                ('float', []) : 42 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])   :  6 | ['estimated_diff_hours', 'hour', 'weekday',
'is_weekend', 'month', …]
        Types of features in processed data (raw dtype, special dtypes):
                ('float', [])     : 40 | ['absolute_humidity_2m:gm3',
'air_density_2m:kgm3', 'ceiling_height_agl:m', 'clear_sky_energy_1h:J',
'clear_sky_rad:W', …]
                ('int', [])       :  5 | ['estimated_diff_hours', 'hour',
'weekday', 'month', 'year']
                ('int', ['bool']) :  3 | ['is_day:idx', 'is_in_shadow:idx',
'is_weekend']
        0.1s = Fit runtime
        48 features in original data used to generate 48 features in processed
data.
        Train Data (Processed) Memory Usage: 9.46 MB (0.2% of available memory)
```

```
Data preprocessing and feature engineering runtime = 0.14s …
AutoGluon will gauge predictive performance using evaluation metric:
'mean_absolute_error'
        This metric's sign has been flipped to adhere to being higher_is_better.
The metric score can be multiplied by -1 to get the metric value.
        To change this, specify the eval_metric parameter of Predictor()
User-specified model hyperparameters to be fit:
{
        'NN_TORCH': {},
        'GBM': [{'extra_trees': True, 'ag_args': {'name_suffix': 'XT'}}, {},
'GBMLarge'],
        'CAT': {},
        'XGB': {},
        'FASTAI': {},
        'RF': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'XT': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini',
'problem_types': ['binary', 'multiclass']}}, {'criterion': 'entropy', 'ag_args':
{'name_suffix': 'Entr', 'problem_types': ['binary', 'multiclass']}},
{'criterion': 'squared_error', 'ag_args': {'name_suffix': 'MSE',
'problem_types': ['regression', 'quantile']}}],
        'KNN': [{'weights': 'uniform', 'ag_args': {'name_suffix': 'Unif'}},
{'weights': 'distance', 'ag_args': {'name_suffix': 'Dist'}}],
}
AutoGluon will fit 2 stack levels (L1 to L2) …
Fitting 11 L1 models …
Fitting model: KNeighborsUnif_BAG_L1 … Training model for up to 39.9s of the
59.86s of remaining time.

Training model for location C…

        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 105.14s compared to 51.84s of available time.
        Time limit exceeded… Skipping KNeighborsUnif_BAG_L1.
Fitting model: KNeighborsDist_BAG_L1 … Training model for up to 37.83s of the
57.79s of remaining time.
        Not enough time to generate out-of-fold predictions for model. Estimated
time required was 57.03s compared to 49.15s of available time.
        Time limit exceeded… Skipping KNeighborsDist_BAG_L1.
Fitting model: LightGBMXT_BAG_L1 … Training model for up to 36.69s of the
56.65s of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -15.6035         = Validation score   (-mean_absolute_error)
        19.08s   = Training   runtime
        46.76s   = Validation runtime
```

```
Fitting model: LightGBM_BAG_L1 … Training model for up to 8.83s of the 28.79s
of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -17.042  = Validation score   (-mean_absolute_error)
        8.57s    = Training   runtime
        14.81s   = Validation runtime
Completed 1/20 k-fold bagging repeats …
Fitting model: WeightedEnsemble_L2 … Training model for up to 59.86s of the
16.36s of remaining time.
        -15.5646         = Validation score   (-mean_absolute_error)
        0.1s     = Training   runtime
        0.0s     = Validation runtime
Fitting 9 L2 models …
Fitting model: LightGBMXT_BAG_L2 … Training model for up to 16.26s of the
16.25s of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -16.1537         = Validation score   (-mean_absolute_error)
        1.9s     = Training   runtime
        0.42s    = Validation runtime
Fitting model: LightGBM_BAG_L2 … Training model for up to 12.14s of the 12.13s
of remaining time.
        Fitting 8 child models (S1F1 - S1F8) | Fitting with
ParallelLocalFoldFittingStrategy
        -15.8514         = Validation score   (-mean_absolute_error)
        1.43s    = Training   runtime
        0.13s    = Validation runtime
Fitting model: RandomForestMSE_BAG_L2 … Training model for up to 8.85s of the
8.84s of remaining time.
        -15.5697         = Validation score   (-mean_absolute_error)
        17.87s   = Training   runtime
        0.55s    = Validation runtime
Completed 1/20 k-fold bagging repeats …
Fitting model: WeightedEnsemble_L3 … Training model for up to 59.86s of the
-9.78s of remaining time.
        -15.4504         = Validation score   (-mean_absolute_error)
        0.14s    = Training   runtime
        0.0s     = Validation runtime
AutoGluon training complete, total runtime = 69.94s … Best model:
"WeightedEnsemble_L3"
TabularPredictor saved. To load, use: predictor =
TabularPredictor.load("AutogluonModels/submission_79_jorge_C/")
```

# 3 Submit

[ ]:
```
import pandas as pd
import matplotlib.pyplot as plt

train_data_with_dates = TabularDataset('X_train_raw.csv')
train_data_with_dates["ds"] = pd.to_datetime(train_data_with_dates["ds"])

test_data = TabularDataset('X_test_raw.csv')
test_data["ds"] = pd.to_datetime(test_data["ds"])
#test_data
```

```
Loaded data from: X_train_raw.csv | Columns = 53 / 53 | Rows = 92951 -> 92951
Loaded data from: X_test_raw.csv | Columns = 52 / 52 | Rows = 2160 -> 2160
```

[ ]:
```
test_ids = TabularDataset('test.csv')
test_ids["time"] = pd.to_datetime(test_ids["time"])
# merge test_data with test_ids
test_data_merged = pd.merge(test_data, test_ids, how="inner", right_on=["time",␣
↪"location"], left_on=["ds", "location"])

#test_data_merged
```

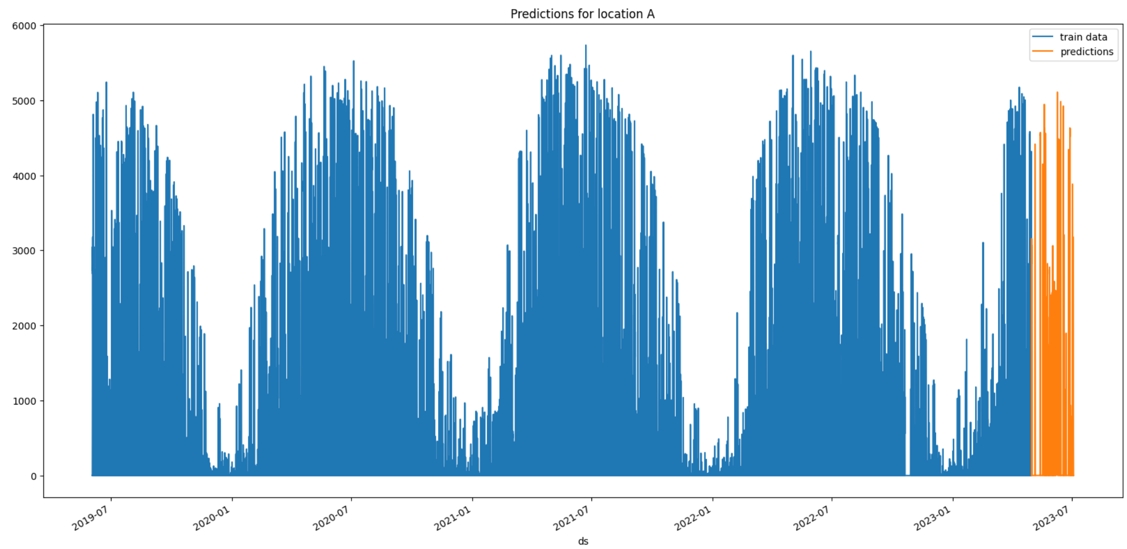
```
Loaded data from: test.csv | Columns = 4 / 4 | Rows = 2160 -> 2160
```

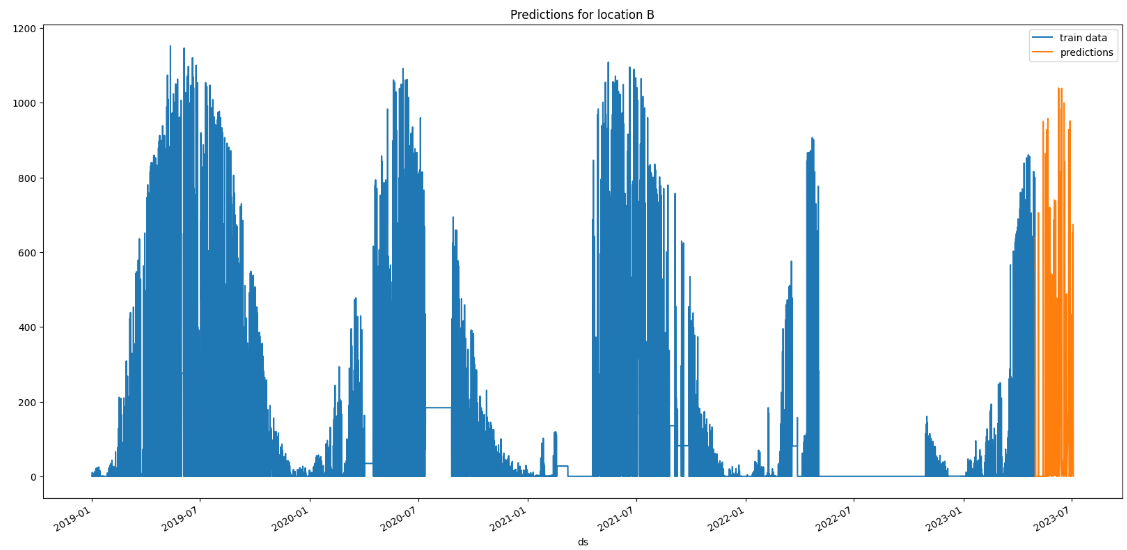
[ ]:
```
# predict, grouped by location
predictions = []
location_map = {
    "A": 0,
    "B": 1,
    "C": 2
}
for loc, group in test_data.groupby('location'):
    i = location_map[loc]
    subset = test_data_merged[test_data_merged["location"] == loc].
↪reset_index(drop=True)
    #print(subset)
    pred = predictors[i].predict(subset)
    subset["prediction"] = pred
    predictions.append(subset)
```

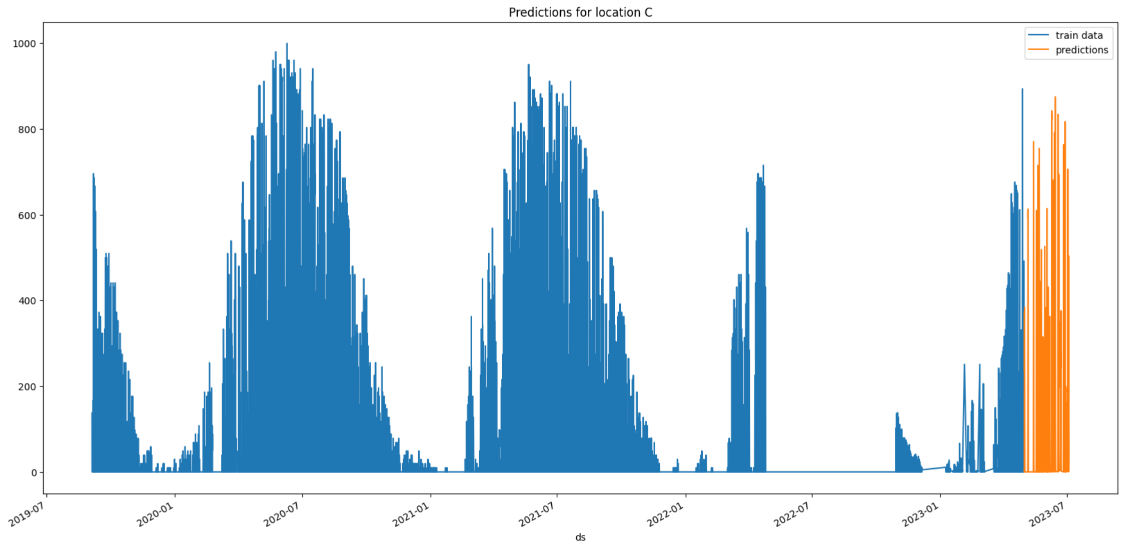
[ ]:
```
# plot predictions for location A, in addition to train data for A
for loc, idx in location_map.items():
    fig, ax = plt.subplots(figsize=(20, 10))
    # plot train data
    train_data_with_dates[train_data_with_dates["location"]==loc].plot(x='ds',␣
↪y='y', ax=ax, label="train data")
```

```python
# plot predictions
predictions[idx].plot(x='ds', y='prediction', ax=ax, label="predictions")

# title
ax.set_title(f"Predictions for location {loc}")
```






[ ]:
```
# concatenate predictions
submissions_df = pd.concat(predictions)
submissions_df = submissions_df[["id", "prediction"]]
submissions_df
```

[ ]:
```
       id  prediction
0       0    1.353503
1       1    1.377337
2       2    1.535772
3       3   50.274967
4       4  298.462311
..    ...         ...
715  2155   91.790527
716  2156   58.327251
717  2157   25.278416
718  2158    3.892292
719  2159    2.036365

[2160 rows x 2 columns]
```

[ ]:
```
# Save the submission DataFrame to submissions folder, create new name based on
 ↪last submission, format is submission_<last_submission_number + 1>.csv

# Save the submission
print(f"Saving submission to submissions/{new_filename}.csv")
submissions_df.to_csv(os.path.join('submissions', f"{new_filename}.csv"),
 ↪index=False)
```

```
Saving submission to submissions/submission_79_jorge.csv
```

[ ]:
```
# save this notebook to submissions folder
import subprocess
import os
subprocess.run(["jupyter", "nbconvert", "--to", "pdf", "--output", os.path.
↪join('notebook_pdfs', f"{new_filename}.pdf"), "autogluon_each_location.
↪ipynb"])
```

```
[NbConvertApp] Converting notebook autogluon_each_location.ipynb to pdf
[NbConvertApp] Support files will be in notebook_pdfs/submission_79_jorge_files/
[NbConvertApp] Making directory
./notebook_pdfs/submission_79_jorge_files/notebook_pdfs
[NbConvertApp] Writing 152138 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', 'notebook']
[NbConvertApp] WARNING | bibtex had problems, most likely because there were no
citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 1471956 bytes to notebook_pdfs/submission_79_jorge.pdf
```

[ ]:
```
CompletedProcess(args=['jupyter', 'nbconvert', '--to', 'pdf', '--output',
'notebook_pdfs/submission_79_jorge.pdf', 'autogluon_each_location.ipynb'],
returncode=0)
```

[ ]:
```
# # feature importance
# location="A"
# split_time = pd.Timestamp("2022-10-28 22:00:00")
# estimated = train_data_with_dates[train_data_with_dates["ds"] >= split_time]
# estimated = estimated[estimated["location"] == location]
# predictors[0].feature_importance(feature_stage="original", data=estimated,␣
↪time_limit=60*10)
```

```
These features in provided data are not utilized by the predictor and will be
ignored: ['ds', 'elevation:m', 'sample_weight', 'location']
Computing feature importance via permutation shuffling for 48 features using
4394 rows with 10 shuffle sets… Time limit: 600s…
        3094.63s        = Expected runtime (309.46s per shuffle set)
        419.07s = Actual runtime (Completed 2 of 10 shuffle sets) (Early
stopping due to lack of time…)
```

[ ]:
```
                                importance    stddev   p_value  n    p99_high  \
direct_rad:W                    179.527752  0.089041  0.000112  2  183.535682
clear_sky_rad:W                 102.034121  0.763313  0.001684  2  136.392434
diffuse_rad:W                    76.319510  0.242082  0.000714  2   87.216140
sun_elevation:d                  48.306937  1.434587  0.006683  2  112.880735
hour                             37.283222  0.841950  0.005082  2   75.181160
sun_azimuth:d                    34.812837  0.901175  0.005826  2   75.376611
direct_rad_1h:J                  28.456567  0.184929  0.001463  2   36.780617
```

| | | | | | |
|---|---|---|---|---|---|
| cloud_base_agl:m | 23.171833 | 0.354225 | 0.003441 | 2 | 39.116231 |
| clear_sky_energy_1h:J | 22.080754 | 0.614640 | 0.006264 | 2 | 49.747021 |
| total_cloud_cover:p | 21.249354 | 0.411635 | 0.004360 | 2 | 39.777903 |
| effective_cloud_cover:p | 17.259895 | 0.014190 | 0.000185 | 2 | 17.898613 |
| month | 16.052628 | 0.649876 | 0.009110 | 2 | 45.304928 |
| ceiling_height_agl:m | 15.125792 | 0.676116 | 0.010058 | 2 | 45.559223 |
| diffuse_rad_1h:J | 14.148167 | 0.011894 | 0.000189 | 2 | 14.683522 |
| relative_humidity_1000hPa:p | 13.232798 | 0.297330 | 0.005057 | 2 | 26.616249 |
| is_day:idx | 12.805033 | 0.807725 | 0.014188 | 2 | 49.162422 |
| wind_speed_u_10m:ms | 12.050327 | 0.464144 | 0.008667 | 2 | 32.942436 |
| weekday | 11.374554 | 0.931762 | 0.018417 | 2 | 53.315108 |
| is_in_shadow:idx | 10.136370 | 0.018201 | 0.000404 | 2 | 10.955648 |
| msl_pressure:hPa | 9.303426 | 0.654040 | 0.015810 | 2 | 38.743145 |
| t_1000hPa:K | 8.931381 | 0.362485 | 0.009132 | 2 | 25.247605 |
| visibility:m | 8.547172 | 0.518337 | 0.013641 | 2 | 31.878598 |
| is_weekend | 8.137093 | 0.320401 | 0.008860 | 2 | 22.559020 |
| wind_speed_10m:ms | 7.407126 | 0.125153 | 0.003803 | 2 | 13.040537 |
| sfc_pressure:hPa | 7.345058 | 0.528305 | 0.016175 | 2 | 31.125179 |
| pressure_100m:hPa | 6.942622 | 0.545800 | 0.017677 | 2 | 31.510253 |
| pressure_50m:hPa | 6.667661 | 0.192459 | 0.006496 | 2 | 15.330645 |
| wind_speed_v_10m:ms | 6.375395 | 0.245266 | 0.008657 | 2 | 17.415344 |
| fresh_snow_24h:cm | 5.625596 | 0.543399 | 0.021708 | 2 | 30.085121 |
| dew_point_2m:K | 4.835024 | 0.656765 | 0.030480 | 2 | 34.397422 |
| estimated_diff_hours | 4.296988 | 0.021430 | 0.001123 | 2 | 5.261618 |
| snow_water:kgm2 | 4.248560 | 0.146461 | 0.007758 | 2 | 10.841074 |
| precip_type_5min:idx | 2.011457 | 0.735394 | 0.080526 | 2 | 35.113079 |
| air_density_2m:kgm3 | 1.468686 | 0.179319 | 0.027413 | 2 | 9.540235 |
| fresh_snow_12h:cm | 1.399083 | 0.050244 | 0.008081 | 2 | 3.660664 |
| absolute_humidity_2m:gm3 | 1.260919 | 0.006155 | 0.001099 | 2 | 1.537983 |
| super_cooled_liquid_water:kgm2 | 0.855587 | 0.032606 | 0.008576 | 2 | 2.323244 |
| snow_depth:cm | 0.446138 | 0.040745 | 0.020528 | 2 | 2.280167 |
| precip_5min:mm | 0.422909 | 0.164053 | 0.085216 | 2 | 7.807265 |
| fresh_snow_6h:cm | 0.291019 | 0.010971 | 0.008483 | 2 | 0.784855 |
| dew_or_rime:idx | 0.104030 | 0.001518 | 0.003285 | 2 | 0.172374 |
| prob_rime:p | 0.038235 | 0.014263 | 0.082092 | 2 | 0.680243 |
| snow_melt_10min:mm | 0.016844 | 0.102404 | 0.427249 | 2 | 4.626258 |
| fresh_snow_1h:cm | 0.012910 | 0.006818 | 0.113768 | 2 | 0.319820 |
| fresh_snow_3h:cm | 0.002094 | 0.028007 | 0.466464 | 2 | 1.262740 |
| wind_speed_w_1000hPa:ms | 0.000000 | 0.000000 | 0.500000 | 2 | 0.000000 |
| rain_water:kgm2 | -0.032241 | 0.039702 | 0.771960 | 2 | 1.754814 |
| year | -0.048251 | 0.020571 | 0.906799 | 2 | 0.877698 |

| | p99_low |
|---|---|
| direct_rad:W | 175.519822 |
| clear_sky_rad:W | 67.675808 |
| diffuse_rad:W | 65.422880 |
| sun_elevation:d | -16.266861 |

```
hour                              -0.614717
sun_azimuth:d                     -5.750937
direct_rad_1h:J                   20.132516
cloud_base_agl:m                   7.227436
clear_sky_energy_1h:J             -5.585513
total_cloud_cover:p                2.720806
effective_cloud_cover:p           16.621176
month                            -13.199671
ceiling_height_agl:m             -15.307639
diffuse_rad_1h:J                  13.612812
relative_humidity_1000hPa:p       -0.150654
is_day:idx                       -23.552357
wind_speed_u_10m:ms               -8.841782
weekday                          -30.566001
is_in_shadow:idx                   9.317091
msl_pressure:hPa                 -20.136293
t_1000hPa:K                       -7.384843
visibility:m                     -14.784253
is_weekend                        -6.284834
wind_speed_10m:ms                  1.773715
sfc_pressure:hPa                 -16.435063
pressure_100m:hPa                -17.625010
pressure_50m:hPa                  -1.995323
wind_speed_v_10m:ms               -4.664554
fresh_snow_24h:cm                -18.833928
dew_point_2m:K                   -24.727373
estimated_diff_hours               3.332359
snow_water:kgm2                   -2.343955
precip_type_5min:idx             -31.090164
air_density_2m:kgm3               -6.602862
fresh_snow_12h:cm                 -0.862498
absolute_humidity_2m:gm3           0.983856
super_cooled_liquid_water:kgm2    -0.612070
snow_depth:cm                     -1.387891
precip_5min:mm                    -6.961447
fresh_snow_6h:cm                  -0.202818
dew_or_rime:idx                    0.035686
prob_rime:p                       -0.603772
snow_melt_10min:mm                -4.592570
fresh_snow_1h:cm                  -0.294000
fresh_snow_3h:cm                  -1.258551
wind_speed_w_1000hPa:ms            0.000000
rain_water:kgm2                   -1.819296
year                              -0.974200
```

[ ]:
```
# # feature importance
# observed = train_data_with_dates[train_data_with_dates["ds"] < split_time]
```

```
# observed = observed[observed["location"] == location]
# predictor.feature_importance(feature_stage="original", data=observed,␣
↪time_limit=60*10)
```

```
These features in provided data are not utilized by the predictor and will be
ignored: ['ds', 'elevation:m', 'sample_weight', 'location']
Computing feature importance via permutation shuffling for 48 features using
5000 rows with 10 shuffle sets… Time limit: 600s…
        4293.33s        = Expected runtime (429.33s per shuffle set)
        359.81s = Actual runtime (Completed 1 of 10 shuffle sets) (Early
stopping due to lack of time…)
```

[ ]:

| | importance | stddev | p_value | n | p99_high \ |
|---|---|---|---|---|---|
| clear_sky_rad:W | 34.800616 | NaN | NaN | 1 | NaN |
| sun_elevation:d | 21.053896 | NaN | NaN | 1 | NaN |
| clear_sky_energy_1h:J | 17.959037 | NaN | NaN | 1 | NaN |
| direct_rad:W | 15.484854 | NaN | NaN | 1 | NaN |
| diffuse_rad:W | 8.571135 | NaN | NaN | 1 | NaN |
| direct_rad_1h:J | 3.283643 | NaN | NaN | 1 | NaN |
| relative_humidity_1000hPa:p | 1.839748 | NaN | NaN | 1 | NaN |
| sun_azimuth:d | 1.549566 | NaN | NaN | 1 | NaN |
| hour | 0.997634 | NaN | NaN | 1 | NaN |
| wind_speed_v_10m:ms | 0.907447 | NaN | NaN | 1 | NaN |
| msl_pressure:hPa | 0.676269 | NaN | NaN | 1 | NaN |
| snow_water:kgm2 | 0.627690 | NaN | NaN | 1 | NaN |
| is_day:idx | 0.620870 | NaN | NaN | 1 | NaN |
| precip_type_5min:idx | 0.312266 | NaN | NaN | 1 | NaN |
| wind_speed_10m:ms | 0.258658 | NaN | NaN | 1 | NaN |
| pressure_100m:hPa | 0.258171 | NaN | NaN | 1 | NaN |
| ceiling_height_agl:m | 0.255112 | NaN | NaN | 1 | NaN |
| sfc_pressure:hPa | 0.224268 | NaN | NaN | 1 | NaN |
| pressure_50m:hPa | 0.223026 | NaN | NaN | 1 | NaN |
| precip_5min:mm | 0.207318 | NaN | NaN | 1 | NaN |
| snow_depth:cm | 0.079170 | NaN | NaN | 1 | NaN |
| air_density_2m:kgm3 | 0.078937 | NaN | NaN | 1 | NaN |
| fresh_snow_12h:cm | 0.077565 | NaN | NaN | 1 | NaN |
| effective_cloud_cover:p | 0.044103 | NaN | NaN | 1 | NaN |
| snow_melt_10min:mm | 0.018210 | NaN | NaN | 1 | NaN |
| fresh_snow_6h:cm | 0.014053 | NaN | NaN | 1 | NaN |
| fresh_snow_3h:cm | 0.004762 | NaN | NaN | 1 | NaN |
| estimated_diff_hours | 0.000000 | NaN | NaN | 1 | NaN |
| wind_speed_w_1000hPa:ms | -0.000056 | NaN | NaN | 1 | NaN |
| prob_rime:p | -0.000317 | NaN | NaN | 1 | NaN |
| fresh_snow_1h:cm | -0.001555 | NaN | NaN | 1 | NaN |
| dew_or_rime:idx | -0.003530 | NaN | NaN | 1 | NaN |
| fresh_snow_24h:cm | -0.015575 | NaN | NaN | 1 | NaN |
| rain_water:kgm2 | -0.020746 | NaN | NaN | 1 | NaN |

| | | | | | |
|---|---|---|---|---|---|
| year | -0.021817 | NaN | NaN | 1 | NaN |
| super_cooled_liquid_water:kgm2 | -0.096266 | NaN | NaN | 1 | NaN |
| cloud_base_agl:m | -0.115793 | NaN | NaN | 1 | NaN |
| t_1000hPa:K | -0.135829 | NaN | NaN | 1 | NaN |
| wind_speed_u_10m:ms | -0.223229 | NaN | NaN | 1 | NaN |
| visibility:m | -0.255399 | NaN | NaN | 1 | NaN |
| is_weekend | -0.301423 | NaN | NaN | 1 | NaN |
| weekday | -0.339798 | NaN | NaN | 1 | NaN |
| total_cloud_cover:p | -0.380572 | NaN | NaN | 1 | NaN |
| diffuse_rad_1h:J | -0.514786 | NaN | NaN | 1 | NaN |
| absolute_humidity_2m:gm3 | -0.560996 | NaN | NaN | 1 | NaN |
| month | -0.563007 | NaN | NaN | 1 | NaN |
| is_in_shadow:idx | -0.585143 | NaN | NaN | 1 | NaN |
| dew_point_2m:K | -1.026145 | NaN | NaN | 1 | NaN |

| | p99_low |
|---|---|
| clear_sky_rad:W | NaN |
| sun_elevation:d | NaN |
| clear_sky_energy_1h:J | NaN |
| direct_rad:W | NaN |
| diffuse_rad:W | NaN |
| direct_rad_1h:J | NaN |
| relative_humidity_1000hPa:p | NaN |
| sun_azimuth:d | NaN |
| hour | NaN |
| wind_speed_v_10m:ms | NaN |
| msl_pressure:hPa | NaN |
| snow_water:kgm2 | NaN |
| is_day:idx | NaN |
| precip_type_5min:idx | NaN |
| wind_speed_10m:ms | NaN |
| pressure_100m:hPa | NaN |
| ceiling_height_agl:m | NaN |
| sfc_pressure:hPa | NaN |
| pressure_50m:hPa | NaN |
| precip_5min:mm | NaN |
| snow_depth:cm | NaN |
| air_density_2m:kgm3 | NaN |
| fresh_snow_12h:cm | NaN |
| effective_cloud_cover:p | NaN |
| snow_melt_10min:mm | NaN |
| fresh_snow_6h:cm | NaN |
| fresh_snow_3h:cm | NaN |
| estimated_diff_hours | NaN |
| wind_speed_w_1000hPa:ms | NaN |
| prob_rime:p | NaN |
| fresh_snow_1h:cm | NaN |

```
dew_or_rime:idx                    NaN
fresh_snow_24h:cm                  NaN
rain_water:kgm2                    NaN
year                               NaN
super_cooled_liquid_water:kgm2     NaN
cloud_base_agl:m                   NaN
t_1000hPa:K                        NaN
wind_speed_u_10m:ms                NaN
visibility:m                       NaN
is_weekend                         NaN
weekday                            NaN
total_cloud_cover:p                NaN
diffuse_rad_1h:J                   NaN
absolute_humidity_2m:gm3           NaN
month                              NaN
is_in_shadow:idx                   NaN
dew_point_2m:K                     NaN
```

[ ]:
```
subprocess.run(["jupyter", "nbconvert", "--to", "pdf", "--output", os.path.
↪join('notebook_pdfs', f"{new_filename}_with_feature_importance.pdf"),␣
↪"autogluon_each_location.ipynb"])
```

```
[NbConvertApp] Converting notebook autogluon_each_location.ipynb to pdf
[NbConvertApp] Support files will be in
notebook_pdfs/submission_79_jorge_with_feature_importance_files/
[NbConvertApp] Making directory
./notebook_pdfs/submission_79_jorge_with_feature_importance_files/notebook_pdfs
[NbConvertApp] Writing 152954 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', 'notebook']
[NbConvertApp] WARNING | bibtex had problems, most likely because there were no
citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 1471953 bytes to
notebook_pdfs/submission_79_jorge_with_feature_importance.pdf
```

[ ]:
```
CompletedProcess(args=['jupyter', 'nbconvert', '--to', 'pdf', '--output',
'notebook_pdfs/submission_79_jorge_with_feature_importance.pdf',
'autogluon_each_location.ipynb'], returncode=0)
```

[ ]:
```
import subprocess

def execute_git_command(directory, command):
    """Execute a Git command in the specified directory."""
    try:
        result = subprocess.check_output(['git', '-C', directory] + command,␣
↪stderr=subprocess.STDOUT)
```

```python
        return result.decode('utf-8').strip(), True
    except subprocess.CalledProcessError as e:
        print(f"Git command failed with message: {e.output.decode('utf-8').
 ↪strip()}")
        return e.output.decode('utf-8').strip(), False

git_repo_path = "."




branch_name = new_filename

# add datetime to branch name
branch_name += f"_{pd.Timestamp.now().strftime('%Y-%m-%d_%H-%M-%S')}"

print(branch_name)

commit_msg = "run result"

execute_git_command(git_repo_path, ['checkout', '-b',branch_name])

# set git user.name and user.email
execute_git_command(git_repo_path, ['config', 'user.name', 'Jorgen eller␣
 ↪Henrik'])
execute_git_command(git_repo_path, ['config', 'user.email', 'jorgen.
 ↪sandhaug@gmail.com'])

# Navigate to your repo and commit changes
execute_git_command(git_repo_path, ['add', '.'])
execute_git_command(git_repo_path, ['commit', '-m',commit_msg])

# Push to remote
output, success = execute_git_command(git_repo_path, ['push',␣
 ↪'origin',branch_name])

# If the push fails, try setting an upstream branch and push again
if not success and 'upstream' in output:
    print("Attempting to set upstream and push again...")
    execute_git_command(git_repo_path, ['push', '--set-upstream',␣
 ↪'origin',branch_name])
    execute_git_command(git_repo_path, ['push', 'origin',branch_name])

execute_git_command(git_repo_path, ['checkout', 'main'])
```

[ ]: ('Switched to branch \'main\'\nYour branch is behind \'origin/main\' by 1 commit, and can be fast-forwarded.\n  (use "git pull" to update your local branch)',
 True)

```
('Switched to branch \'main\'\nYour branch is behind \'origin/main\' by 1
commit, and can be fast-forwarded.\n  (use "git pull" to update your local
branch)',
 True)
```